INSTRUCTIONS

MODEL 1453-23

PRINTER

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Beckman® INSTRUMENTS, INC.
BERKELEY DIVISION

A.C.S.P.

INSTRUCTION MANUAL

MODEL 1453-23 PRINTER

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BECKMAN Instruments Inc.
Berkeley Division
2200 Wright Avenue
Richmond, California

August 1963

BECKMAN/BERKELEY

MODEL 1453-23

PRINTER

The BECKMAN/Berkeley Model 1453-23 is a standard BECKMAN/ Berkeley Model 1453 Printer which has been modified as follows:

1) Lines 1 through 6 are 4-line-logic-controlled. Lines 8 through 12 are 10-line-logic-controlled. Line 7 is 4-line logic controlled and provides the following characters: +, -, F, T, B, AC, Ω, #.

2) The deletion of the 0.1 μf capacitor (C126) between signal ground and chassis makes the chassis completely isolated. The chassis is connected to the AC power ground (3rd wire).

3) R301 in the 10 line decoding modules is changed to 22KΩ.

4) The power input connector is a MS3112-16-8P.

5) The data and control connectors are the MS3126F-22-55P and MS3126F-20-41P types.

6) The printer is wired to provide a ground to override the display of the electronic counter when connected.

7) The front and rear panels as well as the paint is changed to comply with customers specification 1900063.

In all other respects this instrument is standard and the following instruction manual will apply.

REV.	REV.	ZONE	DESCRIPTION	ECO No.	DATE	BY	CHK'D	APP'D
	SA		DRAWN FROM D020-416311		11-13	TVH		

INPUT MODULE A101

P202

BUS LINES TO LIKE PINS OF XA101 THRU XA112

CODE GENERATOR

POWER SUPPLY

CONTROL

PRINTING MECHANISM ELECTRONICS

RESET

CLOCK

STANDBY

PRINT

INHIBIT RESET

PRINT COMMAND

CODE CONTROL

"COLOR" P6P10 10 6

"CONTROL" P6P10 6 8 9

CAM SWITCH

CLUTCH

COLOR CONTROL

TRANSDUCER

RESET COIL

STARTING RELAY

NOTE:
RESISTORS:
WATTAGE — 1/2W UNLESS NOTED
TOLERANCE — 10% " "
CAPACITORS —
CAPACITY — IN μf " "
VOLTAGE — 500V " "
INDICATES POWER GROUND

MODEL 1453-23	NEXT ASSY	MATERIAL	
DRAWN TVH	DATE 11-83	FINISH	
CHECKED	DATE		
CHECKED	DATE		
APPROVED	DATE		
APPROVED	DATE		

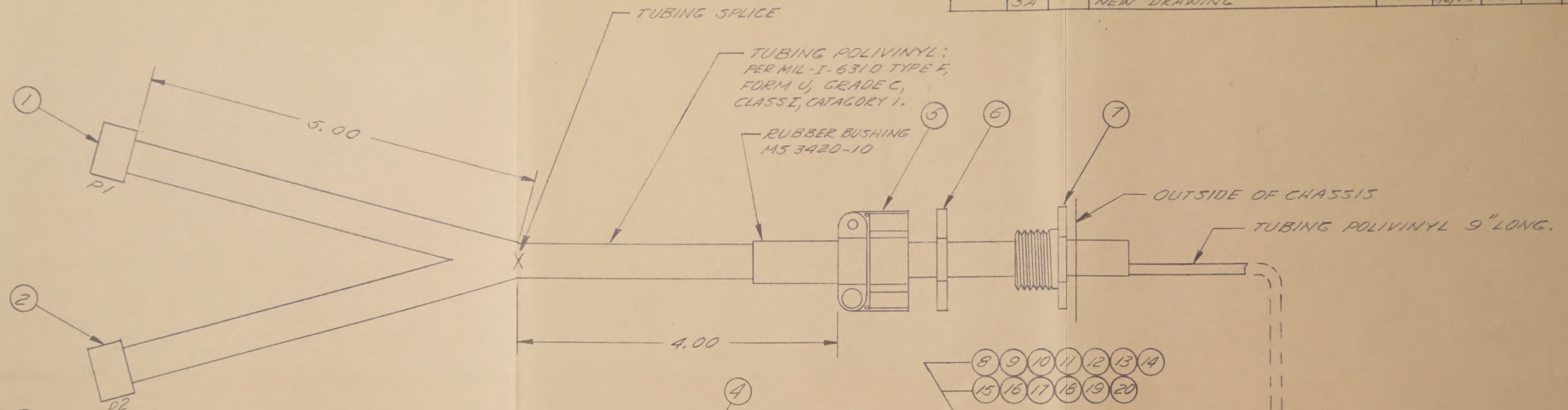
Beckman® / Berkeley
Richmond 3, California

TITLE PRINTER SCHEMATIC

DRAWING No. D020-416568 REV. SA

SCALE

ZONE	REV	EFF	DESCRIPTION	ECO. No.	DATE	BY	CHK'D	APP
	5A		NEW DRAWING		7/2/63	RKN		



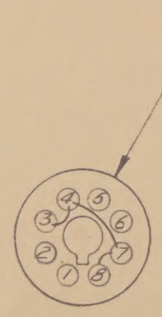
P2

PIN No.	WIRE No.	COLOR	COLUMN No.	PIN No.
p	1	BK-BN	1	1
q	2	BK-RD	1	2
r	3	BK-OR	1	4
s	4	BK-YL	1	6
t	5	BK-GN	1	10
i	6	BK-BL	2	1
j	7	BK-VO	2	2
k	8	BK-GY	2	4
m	9	BK-WH	2	6
n	10	BN-BK	2	10
d	11	BN-BN	3	1
e	12	BN-RD	3	2
f	13	BN-OR	3	4
g	14	BN-YL	3	6
h	15	BN-GN	3	10
Y	16	BN-BL	4	1
Z	17	BN-VO	4	2
a	18	BN-GY	4	4
b	19	BN-WH	4	6
c	20	RD-BK	4	10
T	21	RD-BN	5	1
U	22	RD-RD	5	2
V	23	RD-OR	5	4
W	24	RD-YL	5	6
X	25	RD-GN	5	10
M	26	RD-BL	6	1
N	27	RD-VO	6	2
P	28	RD-GY	6	4
R	29	RD-WH	6	6
S	30	OR-BK	6	10
G	31	OR-BN	7	1
H	32	OR-RD	7	2
J	33	OR-OR	7	4
K	34	OR-YL	7	6
L	35	OR-GN	7	10
F	36	OR-BL	C	1
E	37	OR-VO	C	4
D	38	OR-GY	C	5
C	39	OR-WH	C	6
A	40	BK	C	8

P1

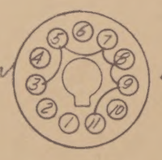
PIN No.	WIRE No.	COLOR	COLUMN No.	PIN No.
X	41	YL-BK	8	1
Y	42	YL-BN	8	2
Z	43	YL-RD	8	3
AA	44	YL-OR	8	4
BB	45	YL-YL	8	5
CC	46	YL-GN	8	6
DD	47	YL-BL	8	7
EE	48	YL-VO	8	8
FF	49	YL-GY	8	9
GG	50	BL	8	10
HH	51	VO	8	11
K	52	YL-WH	9	1
m	53	GN-BK	9	2
n	54	GN-BN	9	3
p	55	GN-RD	9	4
q	56	GN-OR	9	5
r	57	GN-YL	9	6
s	58	GN-GN	9	7
t	59	GN-BL	9	8
u	60	GN-VO	9	9
v	61	GN-GY	9	10
w	62	BL-WH	9	11
Z	63	BL-BK	10	1
a	64	BL-BN	10	2
b	65	BL-RD	10	3
c	66	BL-OR	10	4
d	67	BL-YL	10	5
e	77	BL-GN	10	6
f	78	BL-BL	10	7
g	79	BL-VO	10	8
h	80	GY	10	9
i	81	VO-BK	10	10
j	82	VO-BN	10	11
M	83	VO-RD	11	1
N	84	VO-OR	11	2
P	85	VO-YL	11	3
R	86	VO-GN	11	4
S	87	VO-BL	11	5
T	88	VO-VO	11	6
U	89	VO-GY	11	7
V	90	VO-WH	11	8
W	91	GY-BK	11	9
X	92	GY-BN	11	10
Y	93	GY-RD	11	11
A	94	GY-OR	12	1
B	95	GY-YL	12	2
C	96	GY-GN	12	3
D	97	GY-BL	12	4
E	98	GY-VO	12	5
F	99	GY-WH	12	6
G	100	BN	12	7
H	101	RD	12	8
J	102	OR	12	9
K	103	YL	12	10
L	104	GN	12	11

COLUMN "C"

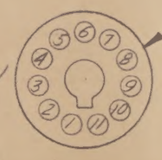


COLUMN #1

COLUMN #5



COLUMN #8



COLUMN #12

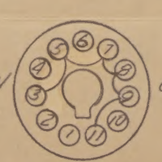
COLUMN #2

COLUMN #6

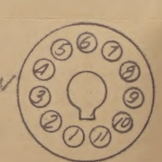
COLUMN #9

COLUMN #3

COLUMN #7

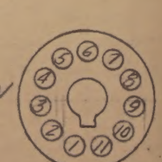


COLUMN #10



COLUMN #4

COLUMN #11



ITEM	PART NO.	DESCRIPTION	QTY.
21	697-012798	HOOD, OCTAL SOCKET	13
20	T697-404585	HOOD SILKSCREEN "C"	1
19	HAND STAMP	12	1
18	↓	11	1
17	↓	10	1
16	↓	9	1
15	T697-404580	8	1
14	T697-404579	7	1
13	T697-404578	6	1
12	T697-404577	5	1
11	T697-404576	4	1
10	T697-404575	3	1
9	T697-404574	2	1
8	T697-404573	1	1
7	A699-404566	AMPENOL AN 3064-10	1
6	699-801709	AMPENOL AN 3066-10	1
5	697-806983	CANNON AN 3057-10A	1
4	860-029566	8 PIN SOCKET	1
3	860-011948	11 PIN SOCKET	12
2	SPECIAL	BURNDY MS 3126F-20-41P	1
1	SPECIAL	BURNDY MS 3126F-22-55P	1

DWG. NO. C SIZE

UNLESS OTHERWISE SPECIFIED	BY	DATE
TOLERANCES	DRAWN RKN	7/2/63
X ±.050 ANGULAR ±0° 30'	CHKD F.V.H	7/3/63
.XX ±.020	ENGR	
.XXX ±.005 MACH. SURF. ✓	APPD	
THREADS: CLASS 2A OR 2B	APPD REL	8/14/63
REMOVE BURRS & SHARP EDGES .020 MAX.		
MACH. FILLET RADIUS .020 R MAX.		
MACH. SURF. FLAT WITHIN .001 IN/IN		
OTHER SURF. FLAT WITHIN .005 IN/IN		
CONCENTRICITY MACH. SURF. TIR WITHIN ½ SUM OF DIA. TOLS., .001 MIN.		
DO NOT SCALE DRAWING		

NEXT ASSY.	USED ON
1453-23	

APPLICATION

TITLE: INPUT CABLE LAY OUT

MATERIAL

FINISH

SCALE

C SIZE

Beckman®

Berkeley Division, Richmond California

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661-416612 5A

SHEET OF REV.

EFF	REV	ZONE	DESCRIPTION	ECO No	DATE	BY	CHK'D	APP
	5A							

— COLUMN SUPPRESSION

R302 220K, 1/4W
R303 3.3K
C3.C .001 µf
CR301 IN461
C301 .001 µf
CR302 IN461
CR304 IN461
R304 220K, 1/4W
R305 220K, 1/4W
CR303 IN461
C3.2 .001 µf
R306 220K, 1/4W
R307 220K, 1/4W
CR305 IN461
CR306 IN461
CR307 IN461
CR308 IN461
CR309 IN461
R308 220K, 1/4W
R309 220K, 1/4W
CR310 IN461
CR311 IN461
C303 .001 µf
R310 220K, 1/4W
R311 220K, 1/4W
CR312 IN461
CR313 IN461
CR314 IN461
C304 .001 µf
R312 220K, 1/4W
R313 220K, 1/4W
CR315 IN461
CR316 IN461
C305 .001 µf
R314 220K, 1/4W
R315 220K, 1/4W
CR317 IN461
CR318 IN461
C306 .001 µf
CR319 IN461
R316 220K, 1/4W
R317 220K, 1/4W
CR320 IN461
CR321 IN461
C307 .001 µf
R318 220K, 1/4W
R319 220K, 1/4W
CR322 IN461
CR323 IN461
C308 .001 µf
C309 220 µµf
R320 5.6K
CR324 IN95
R321 12K
R322 560 Ω
R323 2.2K
R324 3.3K
R325 5.6K
R326 4.7K
CR326 IN461
R327 4.7K
R328 4.7K
S301
1248
1224
COMPARISON INPUT
DATA INPUT
CLOCK INPUT
DRIVE MAGNET
RESET
+16V
+8V
-14V
0V
Q301 2N585
Q302 2N381
Q303 2N404

NOTE:

1) RESISTORS:
   WATTAGE — 1/2 W., UNLESS STATED.
   TOLERANCE — 10%, " "
2) ⬡ — INDICATES PINS OF P301.
3) ○ — INDICATES PINS OF P302.

B587 404453

REF	STK OR DWG No.	ITEM AND DESCRIPTION	QTY.

1453-23	
MODEL	NEXT ASSY
DRAWN	DATE 7/1-'63
CHECKED FVH	DATE 7/1-'63
CHECKED	DATE
APPROVED	DATE
APPROVED	DATE

MATERIAL
FINISH

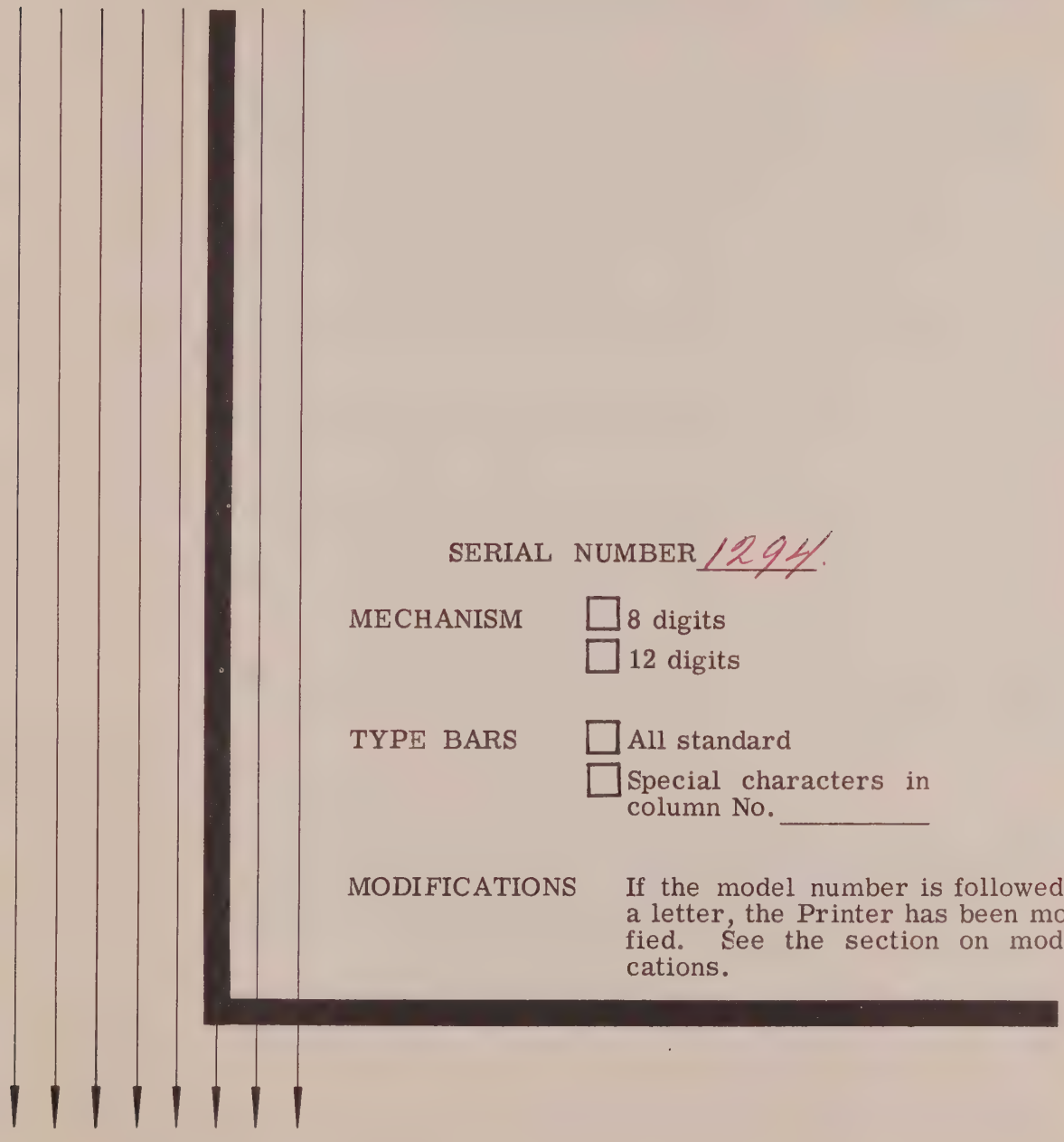
UNLESS SPECIFIED, DIMENSIONS INCHES
DEC TOLERANCES
X = ± 050
.XX = ± 020
XXX = ± 005
ANGULAR = ± 1/2°
SURFACE = 63
SCALE

Beckman® / Berkeley
Richmond 3, California

TITLE: 10-LINE MODULE SCHEMATIC
DRAWING No: C020-416587
REV: 5A

INSTRUCTION MANUAL

MODEL 1453
PRINTER



SERIAL NUMBER 1294.

MECHANISM ☐ 8 digits
☐ 12 digits

TYPE BARS ☐ All standard
☐ Special characters in column No. _____

MODIFICATIONS If the model number is followed by a letter, the Printer has been modified. See the section on modifications.

Beckman® INSTRUMENTS, INC.
BERKELEY DIVISION
2200 Wright Avenue
Richmond, California

August 1962

WARRANTY

Instruments sold by Berkeley Division, Beckman Instruments, Inc., (hereafter called "the Company") are warranted only as stated below.

Subject to the exceptions and upon the conditions specified below, the Company agrees to correct, either by repair, or, at its election, by replacement, any defect of material or workmanship which develops within one year after delivery of the instrument to the original purchaser by the Company or by an authorized representative, provided that investigation and factory inspection by the Company discloses that such defect developed under normal and proper use.

The exceptions and conditions mentioned above are the following:

(a) Some components and accessories by their nature are not intended to, and will not, function one year. If any such component or accessory manufactured by the Company and part of the item sold fails to give reasonable service for a reasonable period of time, the Company will, at its election, replace or repair such component or accessory. What constitutes reasonable service and what constitutes a reasonable period of time shall be determined solely by the Company after the Company is in posession of all the facts concerning operating conditions and other pertinent factors and after such component or accessory has been returned to the Company, transportation prepaid.

(b) All instruments claimed defective must be returned to the Company, transportation charges prepaid, and will be returned to the customer with the transportation charges collect, unless the item is found to be defective in which case the Company will pay all transportation charges.

(c) The Company makes no warranty concerning components or accessories not manufactured by it, such as tubes, fuses, batteries, etc. However, in the event of the failure of any component or accessory not manufactured by the Company, the Company will give reasonable assistance to the purchaser in obtaining from the respective manufacturer whatever adjustment is reasonable in the light of the manufacturer's own warranty.

(d) Except as stated above, the Company makes no warranty, express or implied (either in fact or by operation of law), statutory or otherwise; and, except to the extent stated above, the Company shall have no liability under any warranty, express or implied (either in fact or by operation of law), statutory or otherwise.

(e) The Company expressly disclaims any liability to its customers, dealers, and to users of its products, and to any other person or persons for consequential damages of any kind and from any cause whatsoever arising out of or in any way connected with the manufacture, sale, repair, replacement of, or arising out of or in any way connected with the use of any of its products.

(f) Representations and warranties made by any person, including representatives of the Company, which are inconsistent or in conflict with the terms of this warranty (including but not limited to the limitation of the liability of the Company as set forth above) shall not be binding upon the Company unless reduced to writing and approved by an officer of the Company.

(g) This warranty shall be governed by the laws of the State of California.

Claims for damage in shipment should be filed promptly with the transportation company.

All correspondence concerning the instrument should specify the model and serial number. This information appears on the company name plate. Any inquiry concerning details of operation, possible modifications, etc., should be addressed to the Sales Department, Berkeley division of Beckman Instruments, Inc., Richmond 4, California.

REPAIR SERVICE

Experienced service personnel and special test equipment are available at the factory to perform any necessary repairs. Every effort will be made to expedite the repair of instruments returned for servicing. Repair work will be performed only upon receipt of a written purchase order or authorization. Instruments to be repaired should be addressed to SERVICE AND REPAIR DEPARTMENT with transportation charges prepaid. Repaired instruments will be returned to the purchaser with transportation charges collect.

Berkeley reserves the right to make changes in design at any time without incurring any obligation to modify equipment previously purchased to conform to subsequent design changes.

BERKELEY DIVISION
BECKMAN INSTRUMENTS, INC.

CONTENTS

		Page
SEC. 1	INTRODUCTION	
1.1	General Description	1-1
1.2	Specifications	1-1
SEC. 2	OPERATION	
2.1	Preparing for Operation	2-1
2.2	Controls	2-8
2.3	Operating the Printer	2-10
SEC. 3	THEORY OF OPERATION	
3.1	Basic Design	3-1
3.2	Circuit Logic	3-1
3.3	Control Circuit	3-3
3.4	Position Transducer	3-8
3.5	Input Code Modules	3-10
3.6	Pawl Magnets and Stop Pawls	3-12
3.7	Resetting and Restoring	3-12
3.8	Code Generator	3-14
SEC. 4	SERVICING	
4.1	Preparing the Printer for Servicing	4-1
4.2	Troubleshooting	4-1
4.3	Possible Faults in Operation	4-3
4.4	Mechanical Adjustments	4-5
4.5	Lubrication Procedure	4-9

TYPICAL WAVEFORMS

MODIFICATION H

MODEL 507 STORAGE UNIT

SCHEMATIC DIAGRAMS

Timing Diagram (62-D55)
Model 1453 Master Schematic Diagram (D408311-Rev. B)
4-Line Input Module Schematic Diagram (B404461-Rev. B)
4-Line Cable Schematic Diagram (62-D-56)
10-Line Input Code Module Schematic Diagram (C404454-Rev. A)
10-Line Input Cable Schematic Diagram (62-C-114)

SECTION 1

INTRODUCTION

1.1 GENERAL DESCRIPTION

The Model 1453 Printer converts electrical data into printed characters on a paper tape, printing up to 12 digits in black or red at a maximum rate of 3 lines a second. As normally supplied, the printer has a capacity of 7 digits and will accept binary-coded decimal data of 1-2-2-4, 1-2-4-2, and 1-2-4-8 weighting.

Since each column is controlled by a separate plug-in module, coupled to the main input cable by a separate connector, the user can arrange the digits in any order.

In addition to the standard four-line BCD modules, ten-line modules are available that will accept both decimal and BCD data. With these modules, both types of data can be entered on the same line.

1.2 SPECIFICATIONS

Column Capacity	7 to 12 digit-columns.
Digit Printout	0 through 9, plus column suppression (blank).
Printing Rate	3 lines per second maximum.
Accuracy	Identical to data input sources.
Control Voltages	Binary "0", -12 to -50 volts (maximum). Binary "1", 0 to +50 volts (maximum).
Input Code	FOUR-LINE BCD: 1-2-2-4, 1-2-4-2, or 1-2-4-8. With approximately 2 megohms source resistance per line, binary "0" and binary "1" are as shown under "Control Voltages". With approximately 100K ohms source resistance per line, binary "0" is -8 to -50 volts (maximum), binary "1" is 0 to +50 volts (maximum). TEN-LINE DECIMAL: One wire binary "1", eight wires binary "0". Binary "0" on nine wires represents digit "0".

Input Resistance	FOUR-LINE and TEN-LINE Code Modules: Approximately 10 megohms for negative inputs, 200K ohms for positive inputs.
Code Control	Normally 1-2-2-4 BCD; single line grounded for 1-2-4-8 (1-2-4-2) BCD (1 ma maximum, +10 volts open circuit).
Color Control	Manual: Two-position lever selects red or black print-out. Electrical: Red, binary "1" or open circuit; black, binary "0". Approximately 2 megohms input resistance.
Column Suppression	Single line grounded for each column suppressed. (3 ma maximum, +10 volts open circuit). Removal of input code module also suppresses column.
Print Command	Change from binary "1" to binary "0". Binary "0", 100 ms minimum after print command; binary "1", 15 ms minimum before next print command. Source resistance 1 megohms maximum.
Inhibit Reset Command	Occurs no more than 50 ms after print command; 200 ms maximum duration.
Internal Ground	Internal ground is isolated from chassis ground, and can be biased to ±100 v.
Printing Ribbon	Burroughs adding machine ribbon, 10 key, black and red, medium 7/16" (stock # 812854).
Paper	Standard 2-1/4" roll tape (stock # 823320) or fan-folded tape (stock # 410460).
Power Requirements	117 v rms ±10%, 60 cps. Approximately 0.7 amps, 45 watts.
Dimensions	Printer: 8"H x 8"W x 16"D M-type Portable Case: 10"H x 9"W x 13"D* K-type Rack Adapter: 8-3/4"H x 19"W x 15-1/4"D* L-type Bench Cabinet: 10-5/8"H x 20"W x 15-7/8"D* *(Add 3-1/2"D to include extended front of printer.)
Net Weights	Printer: 30 lb. M-type Portable Case: 5 lb. K-type Rack Adapter: 15 lb. L-type Bench Cabinet: 30 lb.

SECTION 2

OPERATION

2.1 PREPARING FOR OPERATION

2.1.1 Installing the Printer. For protection during shipment, the printer mechanism is screwed to the frame at three points. Do not operate the printer until you have removed the three shipping screws and spacers, as follows:

1) Take the printer out of its case, as described in Section 4.1.

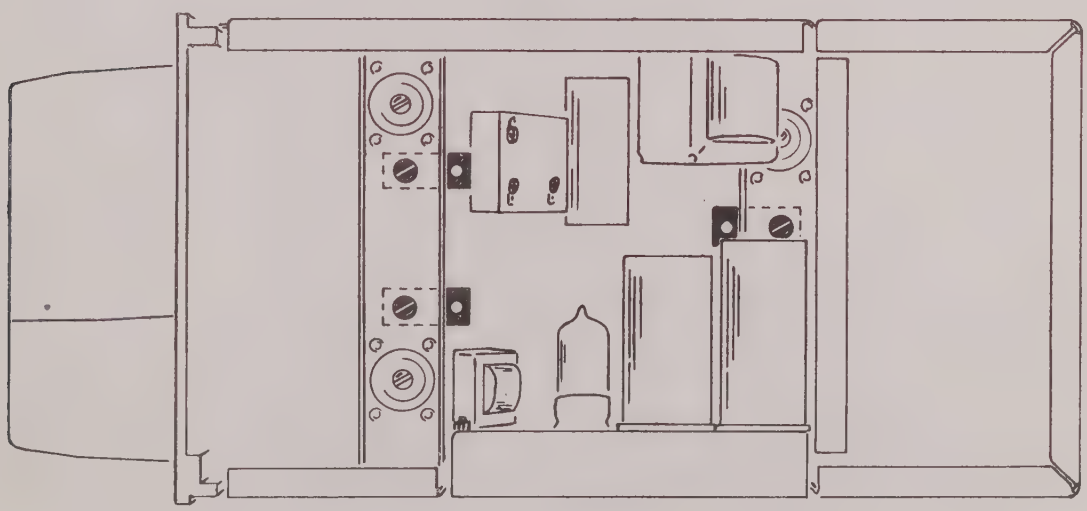
2) Lay the printer on its side, with the front panel to the left and the underside toward you.

3) Find the three red-painted screws and their three spacers. Figure 2-1 shows where they are.

4) Hold each spacer in turn with a pair of pliers while you remove the screw; then remove the spacer.

5) Keep the screws and spacers. You will need them if you ship the printer.

The printer is meant to work horizontally. Do not operate it with the front panel more than 30 degrees from the vertical.



62-A-225

FIG. 2-1. The three shipping screws and spacers, shown heavy, must be removed before operation of the printer.

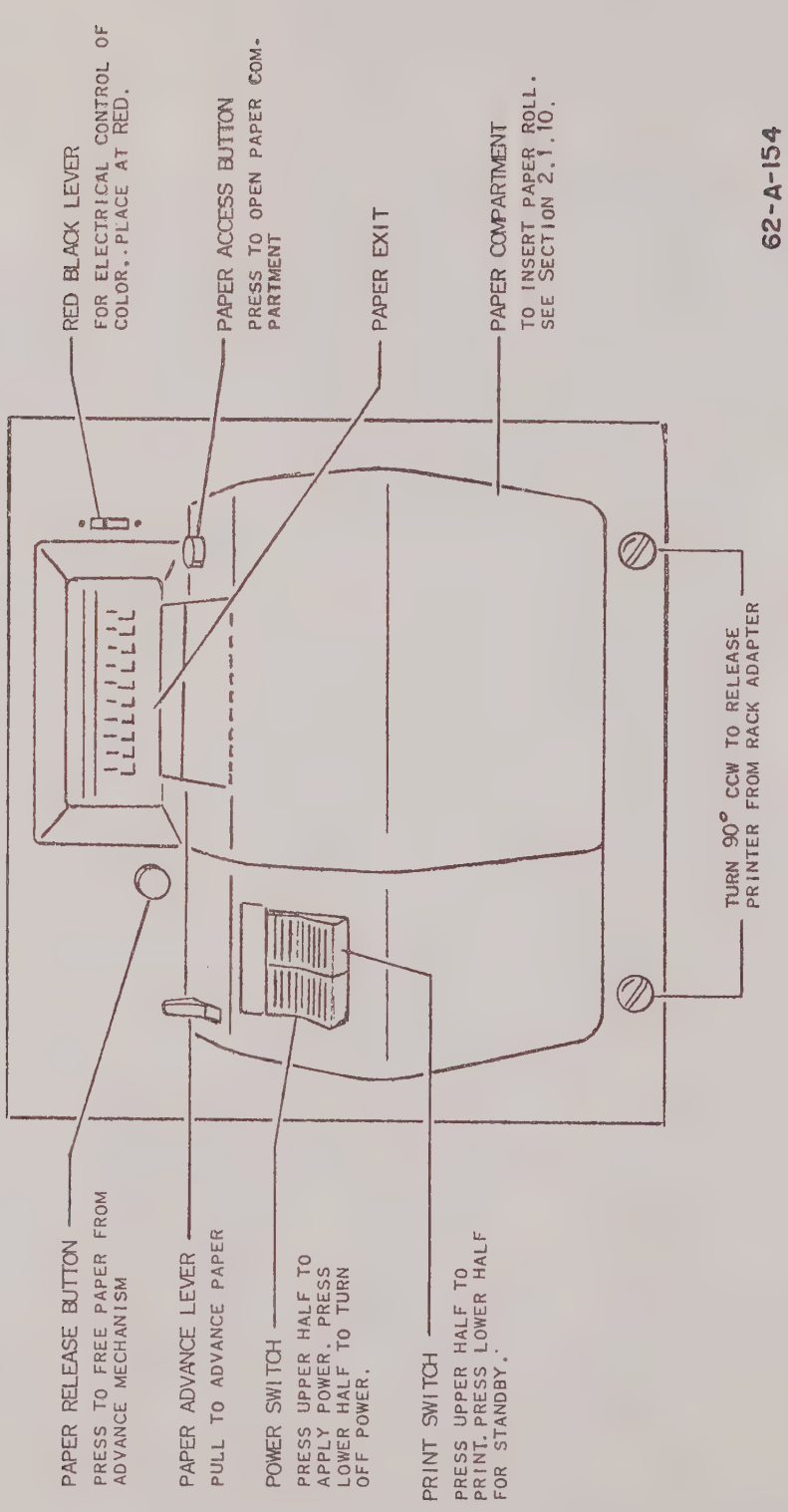

RED BLACK LEVER
FOR ELECTRICAL CONTROL OF COLOR. PLACE AT RED.
PAPER ACCESS BUTTON
PRESS TO OPEN PAPER COMPARTMENT
PAPER EXIT
PAPER COMPARTMENT
TO INSERT PAPER ROLL. SEE SECTION 2.1.10.
TURN 90° CCW TO RELEASE PRINTER FROM RACK ADAPTER
PAPER RELEASE BUTTON
PRESS TO FREE PAPER FROM ADVANCE MECHANISM
PAPER ADVANCE LEVER
PULL TO ADVANCE PAPER
POWER SWITCH
PRESS UPPER HALF TO APPLY POWER. PRESS LOWER HALF TO TURN OFF POWER.
PRINT SWITCH
PRESS UPPER HALF TO PRINT. PRESS LOWER HALF FOR STANDBY.
62-A-154

FIG. 2-2 Front panel controls and connectors of the Model 1453 Printer.

2.1.2 Installing Input Code Modules. As shown on the back of the printer, there are twelve sockets corresponding to the twelve digit columns "1" through "12", reading from right to left across the paper tape, and two chassis connectors marked CONTROL and COLOR. Normally the printer is supplied with seven four-line input code modules and a main cable that is terminated in nine connectors marked "1" through "8" and "C". In this standard form, the 1453 will print up to seven digits of data. For an eighth digit, you simply insert an extra module.

Another version, supplied to special order, has the full complement of 12 pawl magnets and will print up to 12 digits. You can easily tell one version from the other by seeing whether "8 DIGIT" or "12 DIGIT" is stamped on the top of the pawl magnet assembly.

To install modules for use with Beckman data sources, such as counters and digital voltmeters, follow the arrangement in Figure 2-3. With sources other than Beckman instruments, arrange the modules and connectors in any order to suit your purposes.

2.1.3 Code Control with Four-Line Input Code Modules. With four-line modules, the code accepted depends on whether the code control line is grounded or not, as described in Table 2-1. When the printer is used with a Beckman instrument, the instrument automatically provides the proper code control signal.

2.1.4 Using Decimal Data with Ten-Line Input Code Modules. Decimal input to a ten-line module is on nine lines, each wired to a separate pin, numbered 1 through 9 on the module connector (P201). Pin 10 is used for column suppression, as described in Table 2-1. A voltage of binary "1" on any one line represents the digit corresponding to the pin number. Binary "0" on all lines represents the digit "0".

To operate the printer when all modules are ten line:

1) Program the printer for 1-2-2-4 code as explained in Table 2-1.

2) Move the switch on each module to the position marked "1-2-2-4".

2.1.5 Using Mixed Decimal and BCD Data with Ten-Line Input Code Modules

If the data are partially decimal and partly BCD:

1) Program the printer to suit the BCD code you are using, as described in Table 2-1.

2) Move the switch on each module to "1-2-2-4" or "1-2-4-8", according to the BCD code in use.

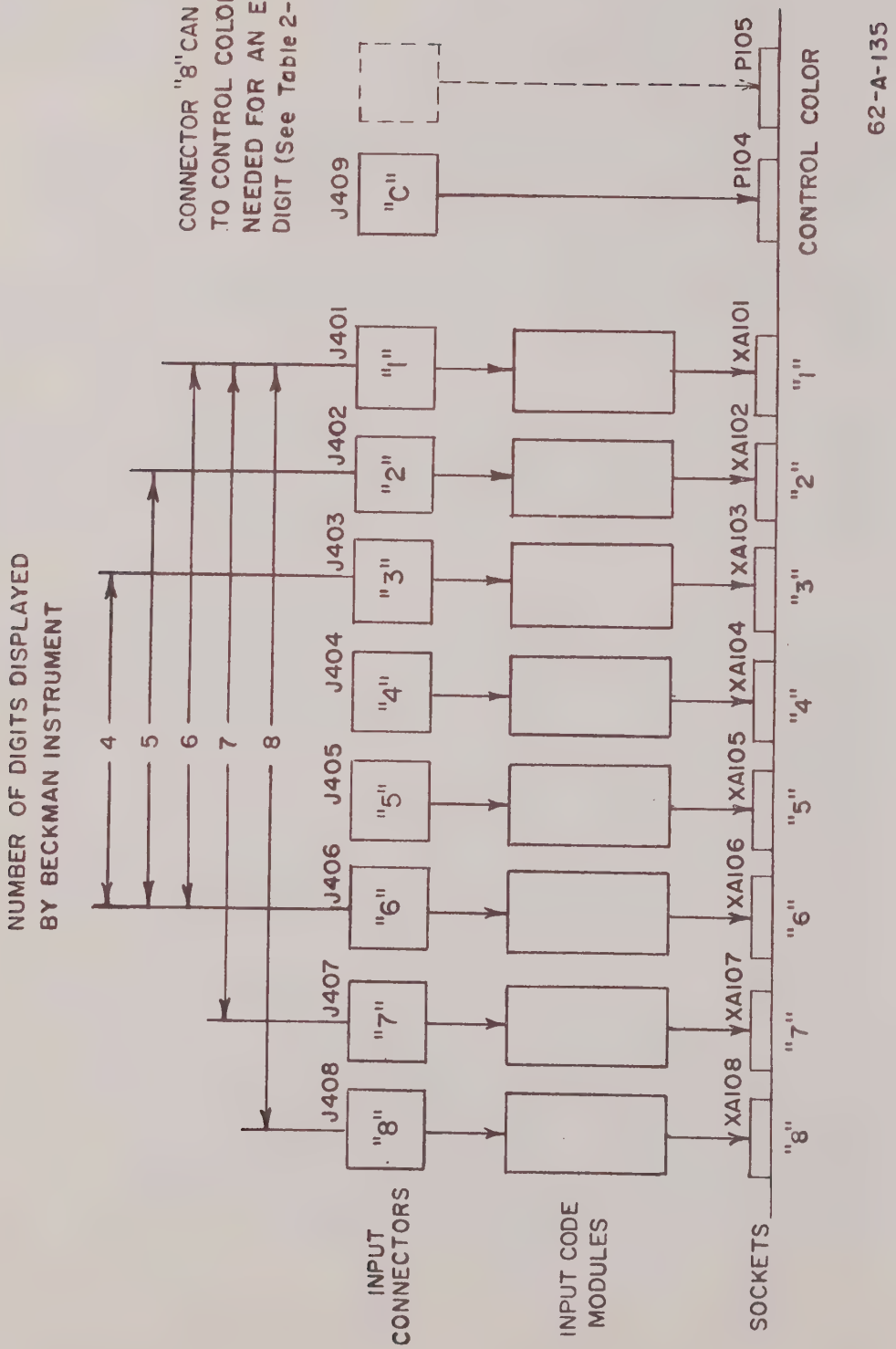


FIG. 2-3 Arrangement of input code modules and connectors when the Model 1453 is used with a Beckman instrument. Numbers "1" through "8" correspond to the digit columns, reading from right to left across the paper tape.

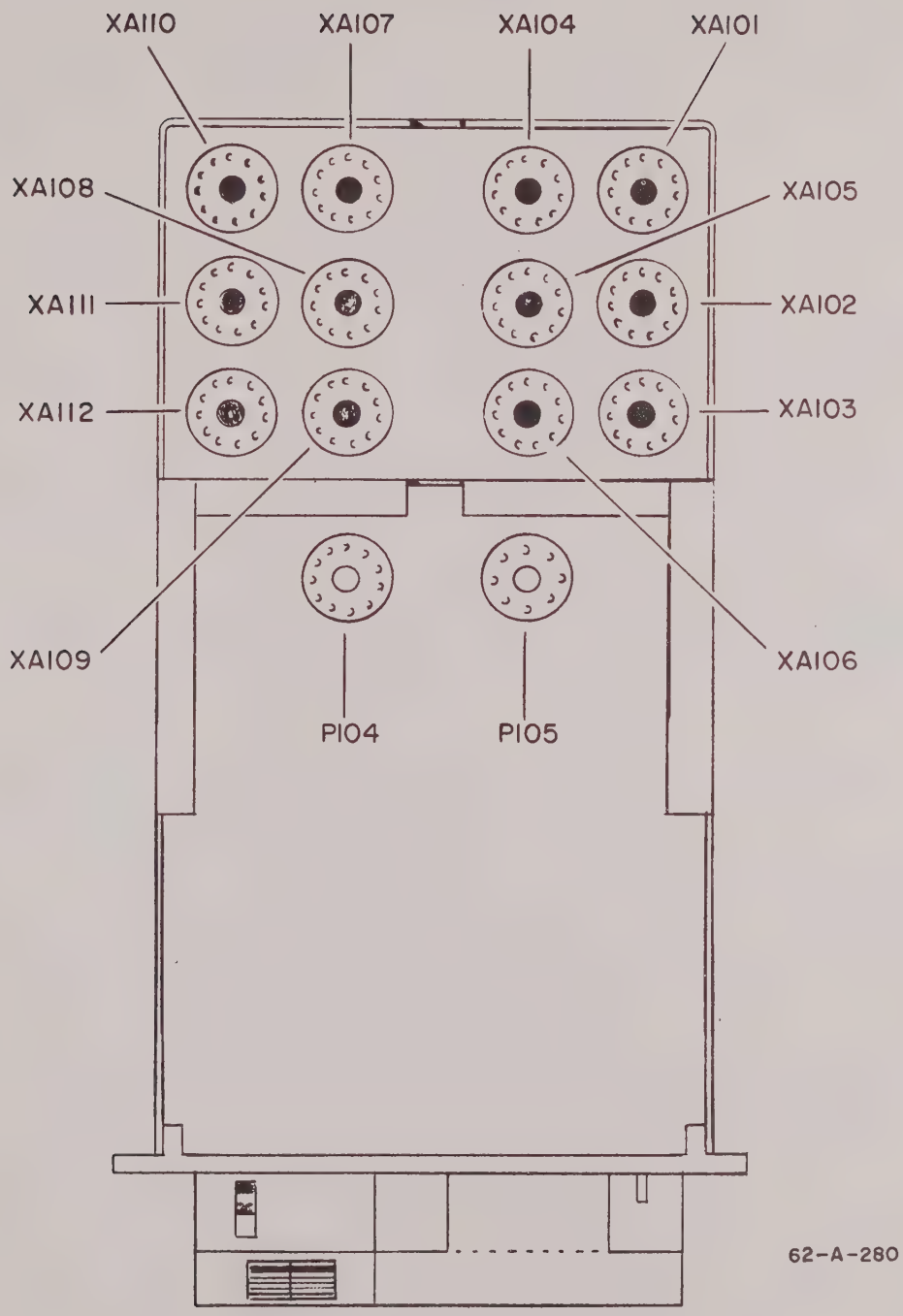


FIG. 2-4. Socket location diagram.

Table 2-1. Electrical Control Functions

Control Signal	Function
Print Command	With the print switch at PRINT, a change from binary "1" to binary "0" at pin 5 of J409 starts a printing cycle. Binary "0" must be maintained for 100 milliseconds minimum to start the cycle. The print command line must return to binary "1" for at least 15 milliseconds before the next cycle can be started.
Code Control	Programs the printer for input data of 1-2-2-4, 1-2-4-2, or 1-2-4-8 weighting (1-2-4-2 and 1-2-4-8 are the same to the Model 1453). A contact closure from pin 7 of J409 to power ground allows 1-2-4-2 or 1-2-4-8 data to be used. With pin 7 ungrounded, the printer is set to respond to 1-2-2-4 code.
Inhibit Reset Command	This command is generated by the printer to stop the data source from resetting before the data have been printed. Available at pin 1 of J409, the command is a contact closure through a 220Ω resistor to power ground occurring no more than 50 milliseconds after print command and lasting no longer than 200 milliseconds after print command.
Color Control	Permits electrical control of the printing color. The red/black lever must be at red for electrical control of color. Binary "1" or open circuit at pin 6 of J408 produces a red impression; binary "0", a black impression.
Column Suppression	Produces a blank impression in the column controlled. A contact closure to power ground from pin 10 of the top connector (P201) of any module will suppress the column. Note that pin 10 of connectors "1", "2", "7", and "8" is wired to the main connector. Removing a module will also suppress the corresponding column.

2.1.6 Using BCD Data with Ten-Line Input Code Modules. BCD input to each ten-line module is on four lines, wired to pins 1, 2, 4, and 6 (corresponding to weights 1, 2, 2, and 4, or 1, 2, 4, and 8, in that order) of the module connector (P201).

To operate the printer with BCD data:

1) Apply the data to pins 1, 2, 4, and 6 of P201.

2) Connect pin 11 (a source of binary "0" bias) to pins 3, 5, 7, 8, and 9.

3) Move the switch on each module to "1-2-2-4".

4) Program the printer for 1-2-2-4 or 1-2-4-8, as described under "Code Control" in Table 2-1.

2.1.7 Identifying Connections to the Input Cables. Wiring diagrams for the four-line and the ten-line input cables are given in the schematic section of the manual.

2.1.8 Connecting a Data Source. To use the printer with a Beckman instrument, simply plug the input cable into the DIGITAL RECORDER socket on the instrument. This socket carries all the data and control signals needed for automatic operation of the printer.

With data sources other than Beckman instruments, you will need to make appropriate connections to the cable, using the input cable schematic diagrams as a guide.

2.1.9 Modifying Older Beckman Instruments. Although Beckman instruments in current production have readout connections that are correct for the Model 1453, earlier instrument need slight modification to suit the 1453. The modification automatically suppresses any digit columns not being used.

To see whether a modification is needed, refer to Table 2-2. If the serial number of the instrument you are using is higher than that shown in the table, take no action. If, however, it is the same as that shown in the table, or if it is lower, add the necessary jumper wires to the DIGITAL RECORDER connector on the instrument.

2.1.10 Inserting the Paper Tape. To put a roll of paper into the printer, follow these steps:

1) Press the paper access button. Figure 2-2 shows where it is.

2) Let the paper compartment drop forward.

3) Place a roll of paper in the spring-loaded holder so that the paper feeds from the bottom toward the mechanism.

4) Bend the end of the paper up toward you, then fold it sharply across to make a straight leading edge.

5) Feed the end into the paper guide below the platen (the rubber roller).

6) Move the paper advance lever toward you several times until the paper appears in the outlet. Make sure that the paper is between the inked ribbon and the platen.

7) Close the compartment.

8) Pressing the paper release button, pull the paper out until it is straight.

Table 2-2. Modifications to DIGITAL RECORDER Connector of Beckman Instruments to ensure compatibility with the Model 1453.

Model	Highest Serial No. *	Pins to be grounded	Model	Highest Serial No. *	Pins to be grounded
5210	299	29, 30, 31, 32	7270	200	32
5220	183	29, 30, 31, 32	7350	1430	30, 31, 32
5230	601	29, 30, 31, 32	7351	262	30, 31, 32
5310	140	30, 31, 32	7360	4224	31, 32
5311	120	30, 31, 32	7361	405	31, 32
5571	1314	31, 32	7370	2374	32
7050	462	30, 31, 32	7700	170	31, 32
7060	552	31, 32	8070	104	32
7070	125	32	8150	102	30, 31, 32
7150	1627	30, 31, 32	8151	111	30, 31, 32
7151	437	30, 31, 32	8160	104	31, 32
7152	105	30, 31, 32	8175	111	32
7160	1098	31, 32	8260	101	31, 32
7161	170	31, 32	8350	103	30, 31, 32
7170	435	32	8351	102	30, 31, 32
7175	200	32	8360	102	31, 32
7250	521	30, 31, 32	8370	123	32
7260	396	31, 32			

*Instruments with this serial number and below will probably need modification. See Section 2. 1. 9 for instructions.

2.1.11 Replacing the Ribbon. To replace the inked ribbon, follow these steps while referring to Figure 2-4:

1) From each side of the printer remove the upper of the two panel-retaining screws; then loosen the screw directly below it.

2) Tip the front panel forward.

3) On each spool, swing the ribbon spool retainer away from the ribbon spool post; then slide off the spool.

4) Remove the ribbon from one spool and discard the old ribbon and the other spool.

5) Attach the free end of the new ribbon to the spool you have kept, making sure that the black edge is against the outer flange of the spool.

6) Place the spools on the spool posts so that the ribbon feeds toward the bottom of the spool.

7) Check that the driving stud in each ratchet wheel is engaged in one of the holes in the spool; then lock the spool with the retainer.

8) Thread the ribbon over the guide stud and through the ribbon guides as shown.

9) Take up any slack in the ribbon by turning the spool that is free. Do not use force.

10) Swing the front panel back into place and replace the two retaining screws.

2.1.12 Applying power. Before connecting the printer to the power line place the POWER switch at the "off" position and the print switch at "standby" by pressing the lower half of each. Then plug the power cord into a 117 volt ac outlet (or a 220 volt outlet if the printer has Modification H).

Place the POWER switch at the "on" position by pressing its upper half. You will hear a subdued noise from the motor, which will now be running with the clutch disengaged. Also, you will see light in the paper outlet, showing that the printer is ready for use.

2.2 CONTROLS

2.2.1 Manual Controls. With the exception of the code weighting switch on the ten-line input code module described in Section 3.5.3, the operating controls are on the front panel. Their positions and functions are shown on Figure 2-2.

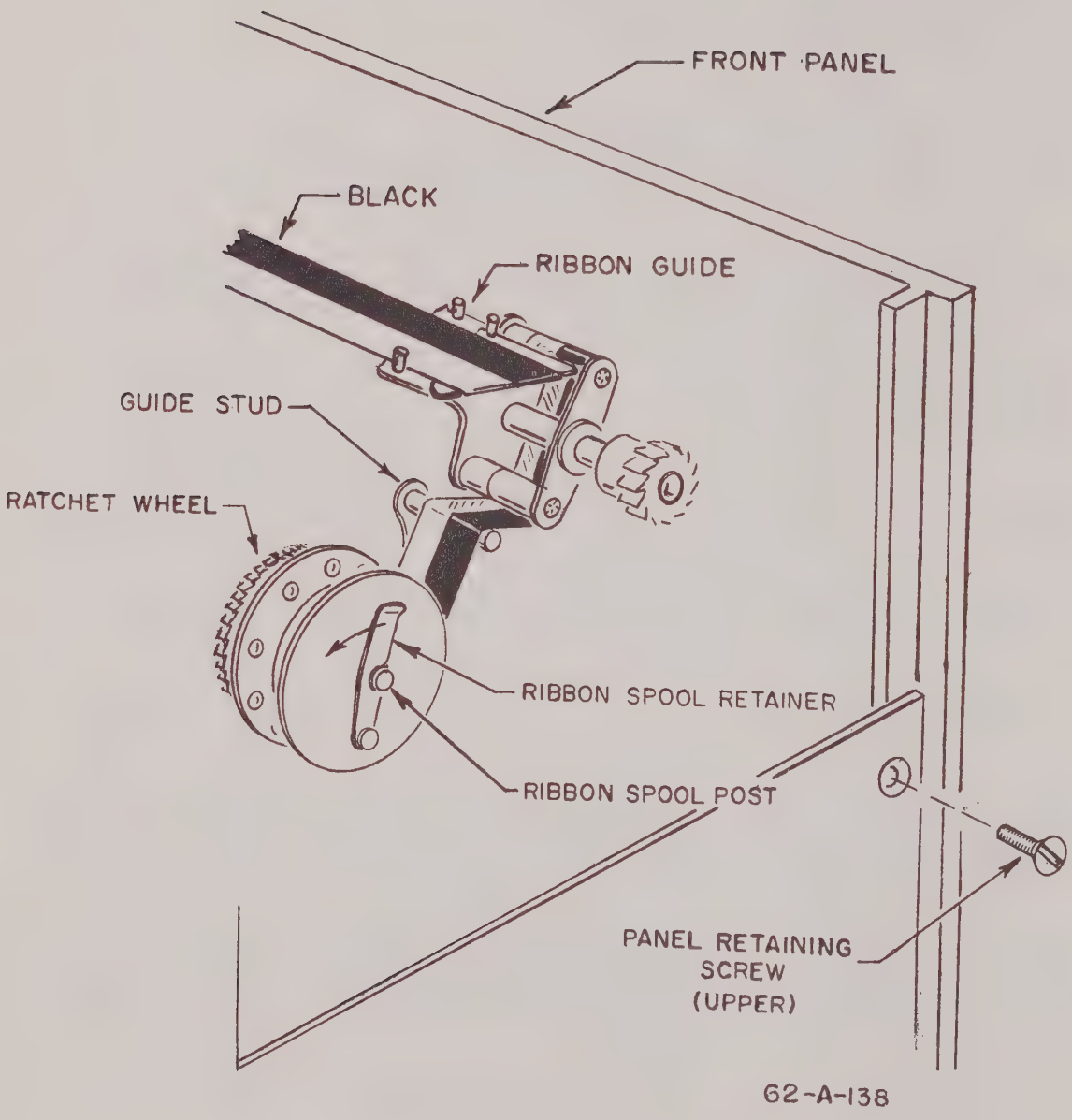


FIG. 2-4. Follow the steps in Section 2.1.11 to replace the inked ribbon.

2.2.2 Electrical Control. Table 2-1 summarizes the electrical controls. In this table, binary "0" means -12 to -50 volts (maximum); binary "1" means 0 to +50 volts (maximum). Note that power ground is not the same as signal ground (see Master Schematic Diagram).

Pin numbers in the table refer to the individual connectors on the printer. To find the corresponding pins on the main connector, see the Four Line Input Cable Schematic Diagram.

2.3 OPERATING THE PRINTER

2.3.1 Recording Data. Once you have made the preparations described in Section 2.1, you need only move the print switch to the PRINT position to record data. With the switch in this position, the printing cycle described in Section 3 will take place upon receipt of an external print command.

2.3.2 Turning off the Printer. When you have finished with the printer, switch to standby before turning off the power. This precaution will ensure that the pawl magnet assembly is mechanically locked in the energized position to prevent the accumulation of dust and lint between the armatures and the magnets.

SECTION 3

THEORY OF OPERATION

3.1 BASIC DESIGN

Designed to record up to 12 digits of data in two colors at rates up to 3 lines a second, the Model 1453 is a motor-driven printing machine controlled by electronic circuits.

Basically, the mechanism is a Burroughs Series J ten key adding machine from which the manually operated listing keys, functional keys, and intermediate keyboard have been removed. Input code modules, pawl magnets, and stop pawls – one set for each column of digits – replace the listing keys and the intermediate keyboard; printing control circuits take the place of the functional keys.

Since the Model 1453 enters data during machine operation instead of before ("parallel entry" in contrast to "serial entry"), the part of the printing cycle needed for data entry is reduced to less than 200 milliseconds. During this period, the 1453 generates an "inhibit reset" signal that can be used to stop the input data from changing.

3.2 CIRCUIT LOGIC

Figure 3-1 shows the circuit logic in simplified form.

In its standby condition, the printer is energized, with the clutch disengaged and the drive motor running freely. A mechanical lock keeps the stop pawls in the "holding" position, clear of the type bars.

When the standby/print switch on the front panel is moved to the PRINT position, the 1453 is made ready to respond to a print command. As soon as the command arrives the clutch control circuit engages the clutch, which then couples power from the motor through a camshaft to the printing mechanism.

The excursion control bar starts its "indexing" movement toward the printing position, followed by the type bars, which are hold against it by springs. At the same time, the lock on the stop pawls is released, leaving them held clear of the type bars by a holding current flowing in the pawl magnet coils.

Driven by the position indicating slide, which is attached to the excursion control bar, the position transducer generates indexing pulses and binary pulses representing the decimal position of the type bar assembly. In

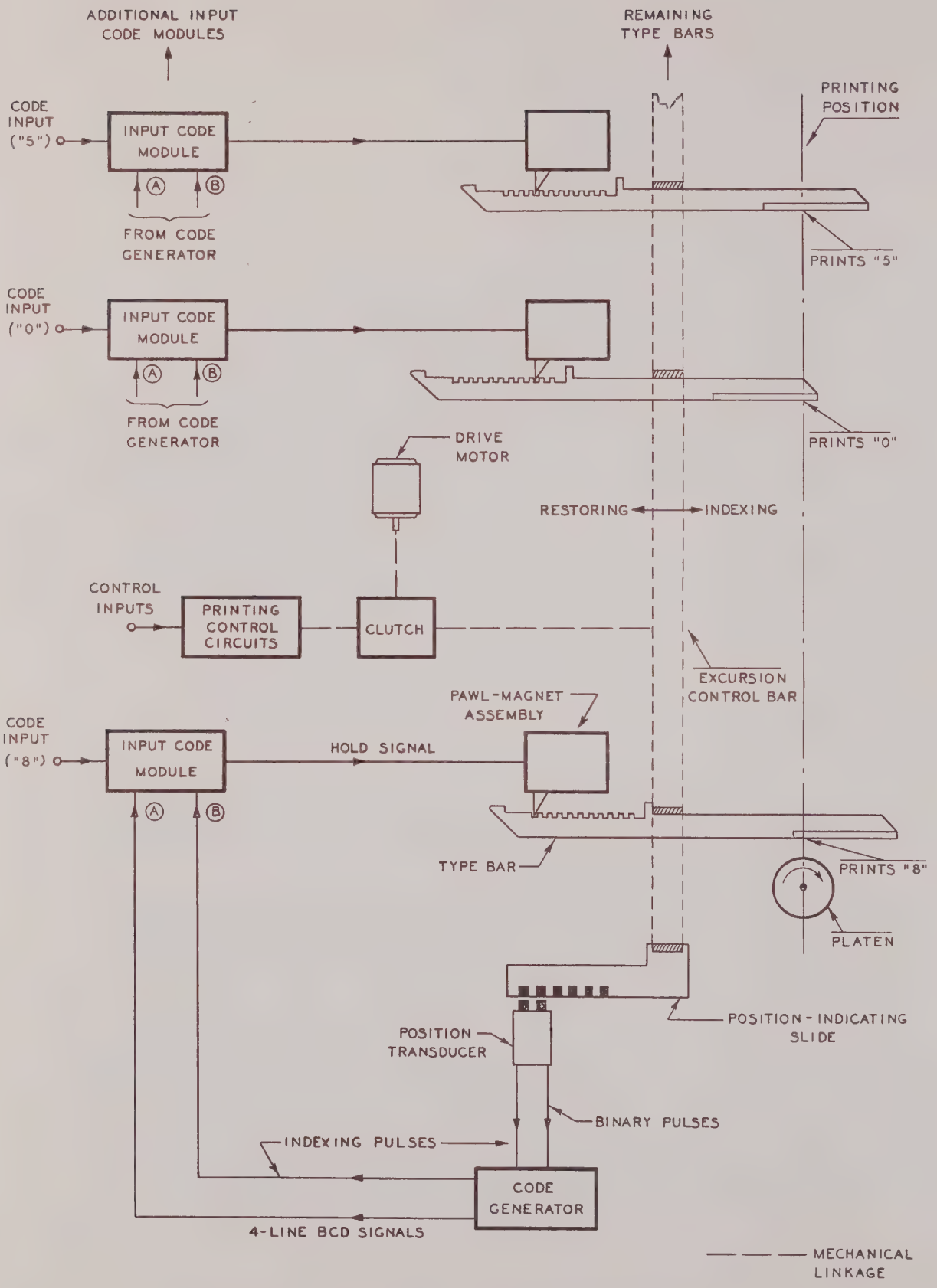


FIG. 3-1 Functional block diagram of the Model 1453.

61-C-52

response to the binary pulses, the code generator produces four-line BCD signals – of 1-2-2-4 or 1-2-4-8 weighting, according to the state of the code control line – which each input code module compares with the four-line BCD data at its input. When the two data sources agree, the type bar is thus in the decimal position corresponding to the input digit. At this moment, the module allows an indexing pulse to cut off the holding current in the pawl magnet. The stop pawl then drops into a notch on the type bar, stopping the bar in the required position.

If there is no input code module plugged in for a particular column of digits, or if a column suppression signal is applied, the module has no source of holding current. As a result, the pawl automatically drops into the "no print" notch at the start of the printing cycle, stopping the type bar in a blank position.

By the time the excursion control bar has completed its indexing travel, all typebars have been correctly latched. The platen then rises, pressing the type faces and inked ribbon against a roll of paper to print one line of data. By using a color lever on the front panel or applying a suitable voltage to the color control line, the operator can make this impression red or black.

After the printing operation, the paper advances one line and the excursion control bar begins its restoring travel, returning the type bars to the starting position and mechanically resetting the pawls. At the same time, the position transducer and code generator are reset. Finally, the clutch is mechanically disengaged, the motor then running freely until the next print command starts a new printing cycle.

3.3 CONTROL CIRCUIT

3.3.1 Design of the Control Circuit. In response to external signals – print command and color control command – the control circuit starts a printing cycle and selects the color of the inpression. Both commands are applied to a control trigger circuit (V101 and Q107) which drives a clutch actuating circuit (Q108 and K103) and a color selector (K102). Interference between clutch control and color control is avoided by the timing sequence of the two functions, as described in Section 3.3.3.

3.3.2 Control Trigger Circuit. Consisting of a cathode follower (V101A) and a trigger stage (V101B and Q107), the control trigger circuit, described in Figures 3-2 and 3-3, serves two main purposes. First, it presents a high input impedance to the external control signals – print command and color control command – and a low output impedance to the solid-state circuitry of the printer. Second, it responds only when the voltage on the print command line drops below a predetermined triggering level of about -8 volts for a period long enough to operate the clutch actuator. As a result, the circuit is not affected by noise transients.

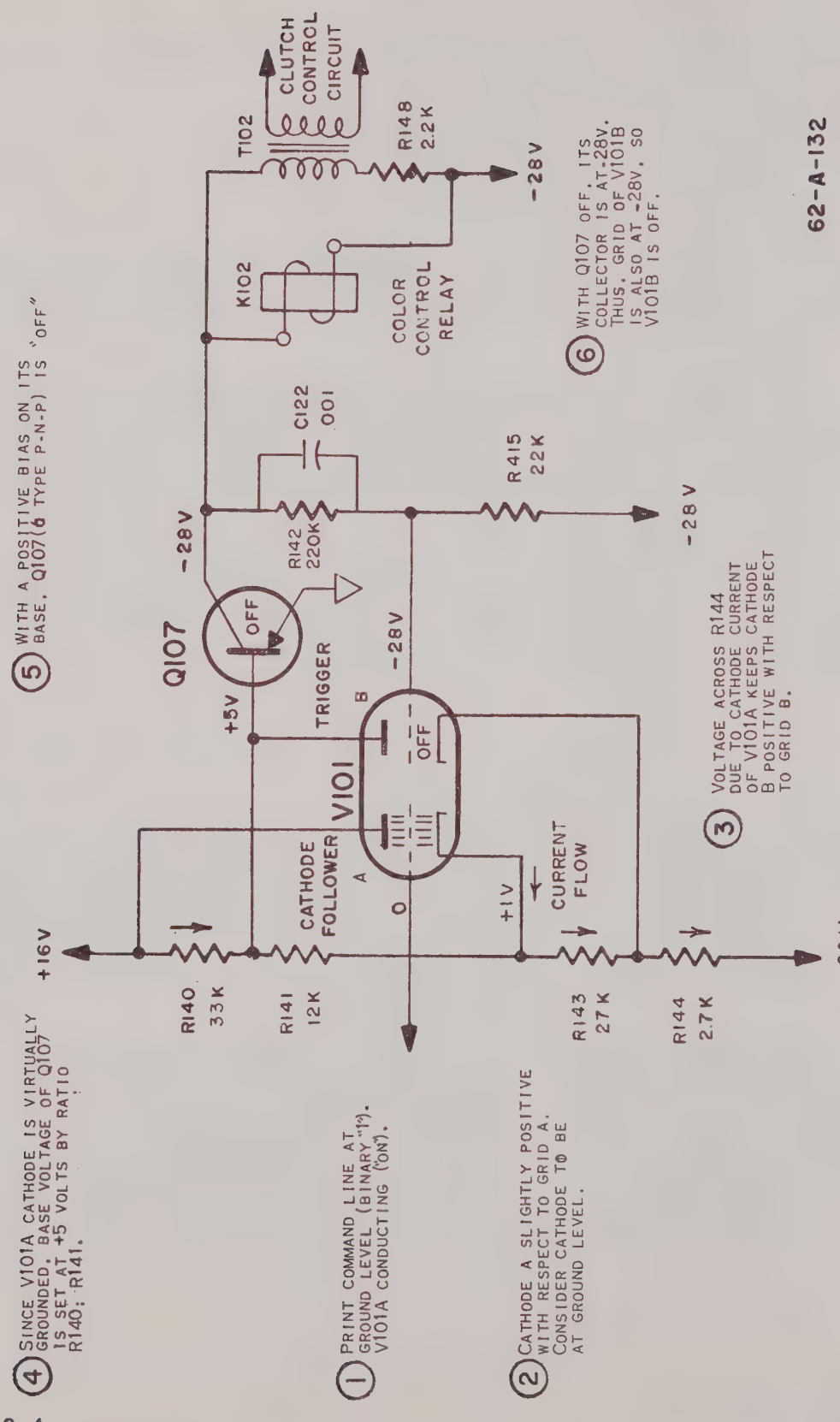

CLUTCH CONTROL CIRCUIT
T102
R148 2.2K
-28 V
K102
COLOR CONTROL RELAY
C122 .001
R142 220K
R415 22K
Q107
OFF
-28 V
+5V
TRIGGER
B
-28 V
V101
OFF
A
CATHODE FOLLOWER
+16 V
R140 33K
R141 12K
+1V
CURRENT FLOW
R143 27K
R144 2.7K
-28 V
-28 V
62-A-132
(1) PRINT COMMAND LINE AT GROUND LEVEL (BINARY "1"). V101A CONDUCTING ("ON").
(2) CATHODE A SLIGHTLY POSITIVE WITH RESPECT TO GRID A. CONSIDER CATHODE TO BE AT GROUND LEVEL.
(3) VOLTAGE ACROSS R144 DUE TO CATHODE CURRENT OF V101A KEEPS CATHODE B POSITIVE WITH RESPECT TO GRID B.
(4) SINCE V101A CATHODE IS VIRTUALLY GROUNDED, BASE VOLTAGE OF Q107 IS SET AT +5 VOLTS BY RATIO R140: R141.
(5) WITH A POSITIVE BIAS ON ITS BASE, Q107 (A TYPE P-N-P) IS "OFF"
(6) WITH Q107 OFF, ITS COLLECTOR IS AT -28V. THUS, GRID OF V101B IS ALSO AT -28V, SO V101B IS OFF.

FIG. 3-2 Quiescent ("reset") state of the Control Trigger Circuit.

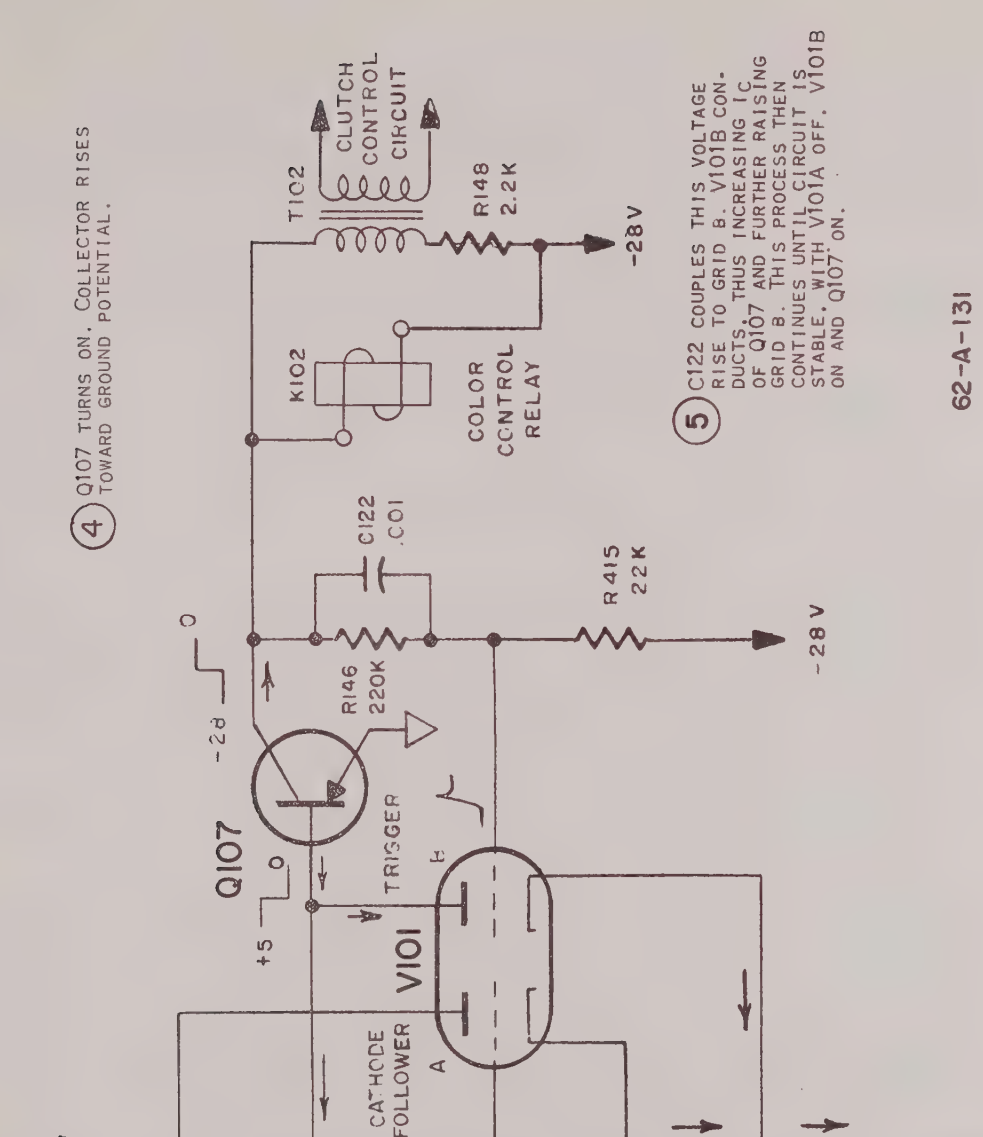

(3) V101A IS NOW OFF, SO HAS NEGLIGIBLE EFFECT ON R140 AND R141, RATIO OF VOLTAGE ACROSS R140 TO VOLTAGE ACROSS R141, R143 AND R144 IS SUCH THAT BASE OF Q107 IS NEGATIVELY BIASED. Q107 THEREFORE GOES ON.
(4) Q107 TURNS ON. COLLECTOR RISES TOWARD GROUND POTENTIAL.
(1) AT TIME OF PRINT COMMAND, GRID A DROPS TO -12 VOLTS OR MORE NEGATIVE (BINARY "0"), CUTTING OFF V101A.
(2) WITH V101A OFF, VOLTAGE ACROSS R144 DIMINISHES, CATHODE B GOES MORE NEGATIVE, SO GRID B GOES MORE POSITIVE.
(5) C122 COUPLES THIS VOLTAGE RISE TO GRID B. V101B CONDUCTS, THUS INCREASING I_C OF Q107 AND FURTHER RAISING GRID B. THIS PROCESS THEN CONTINUES UNTIL CIRCUIT IS STABLE, WITH V101A OFF, V101B ON AND Q107 ON.
+16V
R140 33K
R141 12K
CATHODE FOLLOWER
V101
A
B
TRIGGER
+5
0
-12
Q107
-28
R146 220K
C122 .001
R415 22K
-28 V
K102
COLOR CONTROL RELAY
T102
CLUTCH CONTROL CIRCUIT
R148 2.2K
-28V
R143 27K
R144 2.7K
-28 V
62-A-131

FIG. 3-3 Response of the Control Trigger Circuit to a command. At the end of the command, grid A rises to ground and a reverse process returns the circuit to its reset state.

3.3.3 Control Logic. Figure 3-4 shows the circuit that controls clutch engagement and printed color in response to external commands. Referring to the circled numbers on the illustration, the operating sequence, shown graphically in the timing diagram at the back of the manual, is as follows:

1) In the ready state – that is, before a print command is received – clutch actuator K103 is de-energized. The motor is running with the clutch disengaged, so the printer mechanism is at rest.

2) A print command passes through contact A of K103 to the control trigger, which generates a 28-volt positive output step as shown in Figure 3-3.

3) Transformer T102 differentiates this step, producing a positive pulse at end A and a negative pulse at end B.

4) If the print switch (S102) is in the PRINT position, diode CR117 conducts, returning the base of transistor Q108 to ground through contact C of K103. Since Q108 is of type P-N-P, the negative pulse at its base turns it on. Collector current then flows, energizing K103. As soon as the armature of K103 begins to move, it releases a mechanical trip that engages the clutch. The camshaft then begins to rotate.

5) Contact D of K103 closes. Thus, K103 is latched through resistor R149 and becomes independent of Q108.

6) As the armature of K103 continues its travel, contact C breaks the ground return to the base of Q108, turning off Q108 so that subsequent operation of the control trigger circuit during the color control sequence will have no effect on the clutch control circuit.

7) Contact B of K103 closes, grounding the inhibit reset line. This inhibit reset command is used to prevent reset of the data source before data entry is complete.

8) Contact A of K103 opens, disconnecting the print command line from the control trigger circuit, which now becomes available for the color control function.

9) The color printed is determined by the amount of travel of the ribbon shift mechanism, which moves either the red or the black portion of the ribbon into a position between the type face and the paper for the printing operation. To print red, the ribbon guides are allowed full travel. To print black, however, the movement is restricted by linkages operated manually from the front-panel red/black lever, or electrically by the color selector, K102.

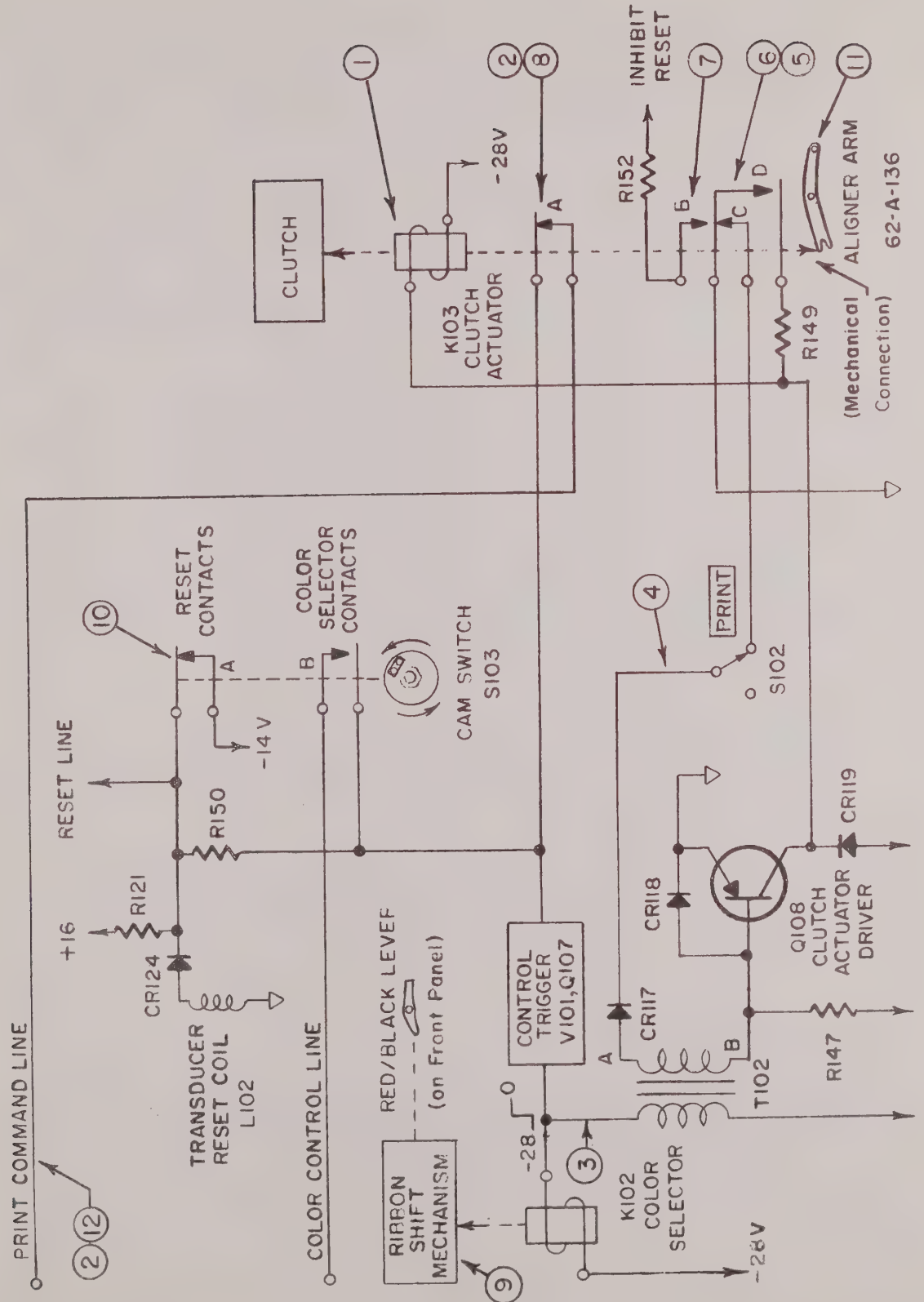


FIG. 3-4 Control Circuit, simplified. The circled numbers refer to the description in Section 3.3.3.

For electrical selection of color, the front-panel lever must therefore be set at red. Then, with binary "1" (0 to +50 volts) on the color control line, the output of the control trigger circuit will be -28 volts, as described in Figure 3-3. Thus, K102 will be de-energized and red will be printed. With binary "0" (-12 to -50 volts) on the color control line, however, K102 will be energized and black will be printed.

Note that K102 is energized by the initial print command and remains energized after contact A of K103 opens (step 8), since the input to the control trigger is held negative by resistor R150, connected to -14 volts through contact A of the cam switch, S103. After rotation of the camshaft has opened S103A, however, the control trigger input voltage rises because R150 is connected to +16 volts through R121. At this time, K102 will be de-energized unless a "print black" signal is present on the color control line.

10) When data entry is complete – about half way through the mechanical cycle – S103A closes again, but the change from ground to negative at the control trigger input does not have any effect on the clutch actuator, since contact C of K103 is still open (see step 6).

11) The aligner arm now locks the type bars in their selected positions, at the same time pressing the armature of K103 into the de-energized position, unlatching K103. The control circuit is again able to accept a print command, and the external source is free to provide new data. However, the clutch remains engaged until the end of the cycle, by which time the data have been printed and the type bars restored to their starting position.

Since the input to the control trigger circuit is already held negative through R150 and S103A, the closing of K103A cannot produce a false print command. The input needs to be raised to ground level or above and then dropped below the triggering level before the clutch control circuit will respond.

12) If a new print command arrives before the cycle is complete, the mechanism does not stop at the end of the cycle. Instead, the command will trigger the clutch actuator so that the clutch remains engaged.

3.4 POSITION TRANSDUCER

Combining the inherent reliability of the electronic transducer and the simplicity of the mechanical commutator, the position transducer, shown in Figure 3-5, is a mercury-wetted DPST switch, sealed in a capsule that is filled with inert gas under high pressure. The mercury ensures bounce-free contact, permitting the transducer to be connected directly to the electronic circuits without the need for pulse shaping.

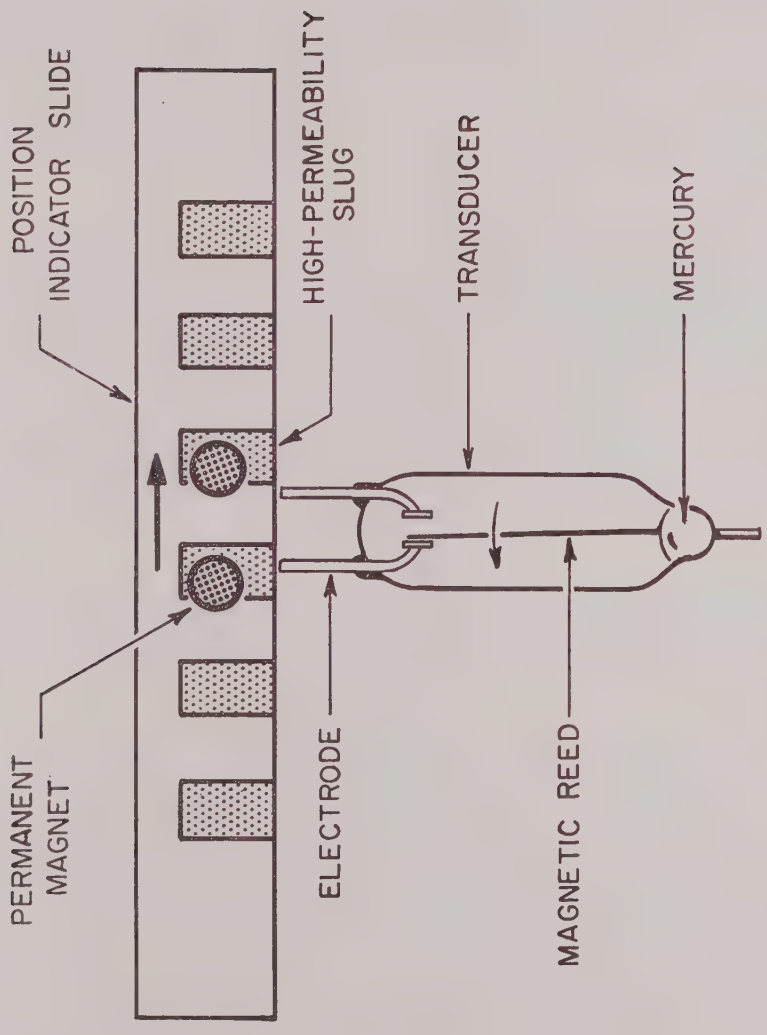


FIG. 3-5 Position transducer.

Two permanent magnets, one opposite each electrode, establish a symmetrical field near the electrodes. Attached to the excursion control bar, the position indicating slide places magnetic slugs between the magnets and the electrodes, distorting the field so that the magnetic reed of the transducer is attracted to the nearest slug. The spacing of the magnets and slugs is such that the reed switches from one electrode to the other for each decimal position of the type bars, generating the first place of a four-line BCD position code. At the same time, signals from one electrode trigger the flip-flop chain of the code generator, which then provides the other three places of the position code.

3.5 INPUT CODE MODULES

3.5.1 General Design Features. Two kinds of input code modules are available for the Model 1453: a four-line module for BCD data of 1-2-2-4, 1-2-4-2, and 1-2-4-8 weighting, and a ten-line module accepting both ten-line and four-line data. (To the 1453, 1-2-4-2 and 1-2-4-8 are the same). Each module can be plugged into any of twelve sockets, numbered "1" through "12" to correspond to the positions of the digit columns. Up to 12 digits of coded data, each coupled to an individual numbered connector on a flexible cable, can then be plugged into the modules in any order. Thus, the operator can place the digits in any order on the printed line.

3.5.2 Four-Line Input Code Module. A solid-state device, the BCD module consists of a first coincidence comparator, a two-stage trigger circuit (Q201, Q203) and a pawl magnet driver (Q202) as shown in Figure 3-6.

Clock pulses generated for each position of the type bar assembly are applied to the trigger circuit through an attenuator whose attenuation factor is high when any coincidence diode (CR201, CR203, CR206, or CR208) is conducting, and low when all four diodes are non-conducting. At the anodes of the diodes are the four lines of BCD data from the external input source; at the cathodes are the four lines of similarly coded data from the code generator. As long as the decimal digits represented by the two data sources are different, at least one of the diodes is conducting. Consequently, the clock pulses are attenuated to about +5 volts, too small to affect the trigger circuit. During this quiescent condition, the trigger is in the reset state, which keeps Q202 in conduction. Since the collector of Q202 is returned to -14 volts through the pawl magnet, the magnet is energized and the stop pawl is held clear of the type bar.

When the input data and the position data coincide, however, all four diodes are non-conducting. Consequently, a clock pulse arriving at that time is able to attain enough amplitude to switch the trigger circuit

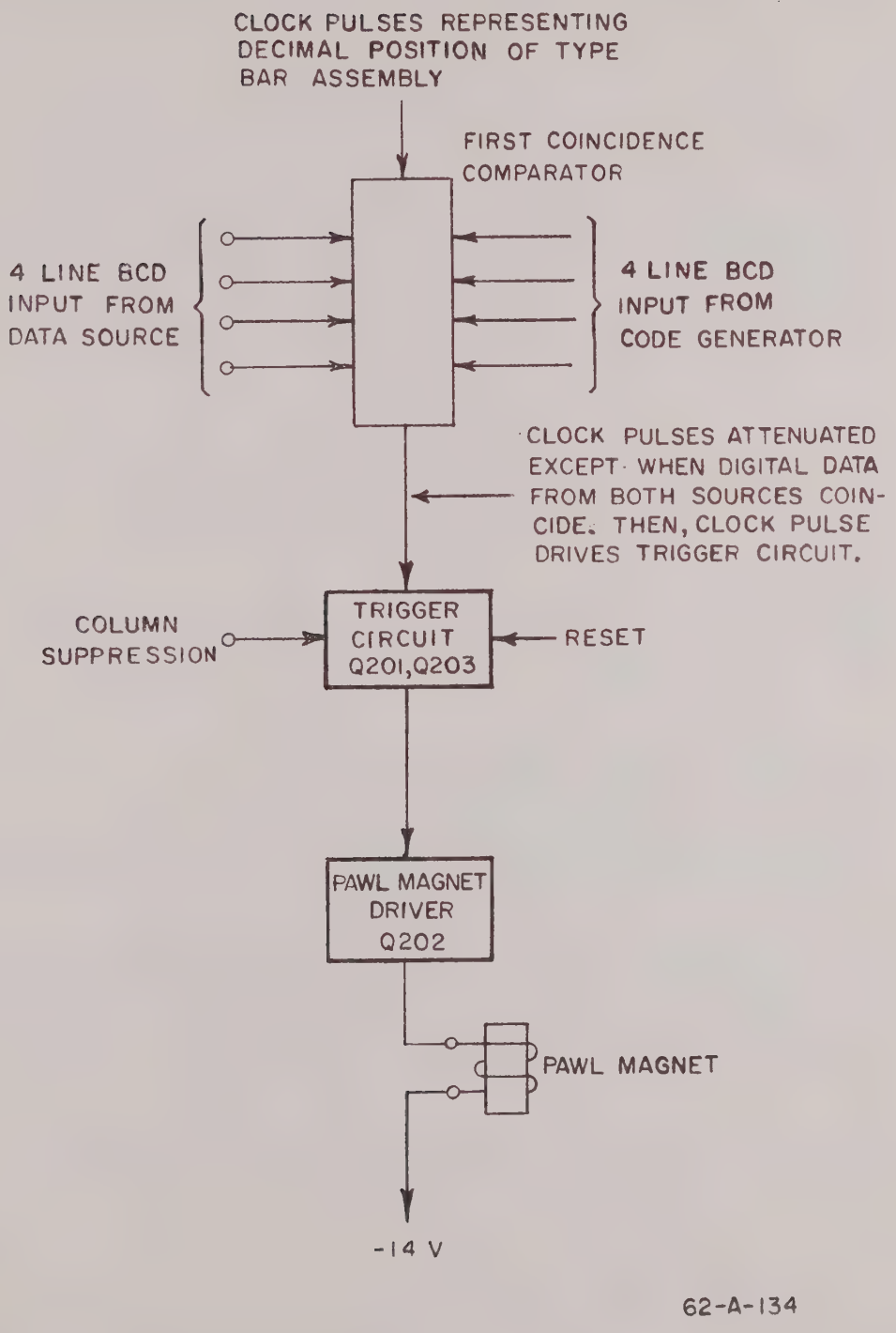

CLOCK PULSES REPRESENTING DECIMAL POSITION OF TYPE BAR ASSEMBLY
FIRST COINCIDENCE COMPARATOR
4 LINE BCD INPUT FROM DATA SOURCE
4 LINE BCD INPUT FROM CODE GENERATOR
CLOCK PULSES ATTENUATED EXCEPT WHEN DIGITAL DATA FROM BOTH SOURCES COINCIDE. THEN, CLOCK PULSE DRIVES TRIGGER CIRCUIT.
COLUMN SUPPRESSION
TRIGGER CIRCUIT Q201,Q203
RESET
PAWL MAGNET DRIVER Q202
PAWL MAGNET
-14 V
62-A-134

FIG. 3-6 Logic of the four-line BCD Input Module.

to its other stable state, turning off Q202 and allowing the stop pawl to drop. During the restoring part of the printing cycle, a contact closure in the cam switch resets the trigger, turning Q202 on again and restoring the holding current in the pawl magnet.

Since each pawl magnet derives its holding current from the corresponding input module, removal of the module de-energizes the magnet. Consequently, as soon as the mechanical lock on the magnet armatures is released at the beginning of a printing cycle, the stop pawl of any de-energized magnet drops, latching its type bar in the "no-print" position. This column suppression feature thus automatically ensures that no data will be recorded in any digit column that does not have an input module. Column suppression can also be controlled remotely by a contact closure to power ground from one pin on the top connector of any module. Grounding this pin switches the trigger in the module to the state that turns off transistor Q202, allowing the stop pawl to drop when the reset signal is removed at the beginning of the cycle.

3.5.3 Ten-Line Input Code Module. In the ten-line input code module, a diode matrix first translates the decimal input data into four-line BCD data, weighted 1-2-2-4 or 1-2-4-8 according to the position of a switch on the module. From this point on, the circuit is the same as that of the four-line module.

Since the ten-line module accepts both ten-line data and BCD data, a printer fitted with these modules is able to record both types of information on one line.

3.6 PAWL MAGNETS AND STOP PAWLS

Replacing the manually operated listing, or numeral, keys of the standard adding machine, the pawl magnet assembly controls the type bars: one pawl magnet, one stop pawl, and one input code module to each type bar.

During the indexing movement of the type bars, each input code module is comparing BCD data from the code generator with BCD data from the external source. As soon as the two sources coincide, indicating that the type bar is in the correct decimal position, the holding current for the corresponding pawl magnet is cut off. The stop pawl then drops into a notch on the type bar, stopping further movement.

Figure 3-7 shows a cross section of the pawl magnet assembly with one stop pawl in the holding position and another stop pawl released. Typical drop-in time for a pawl is 3 milliseconds.

3.7 RESETTING AND RESTORING

As part of the over-all requirement of keeping the electronic control circuits at low power levels, the resetting and restoring actions have been designed to derive their power entirely from mechanical linkages.

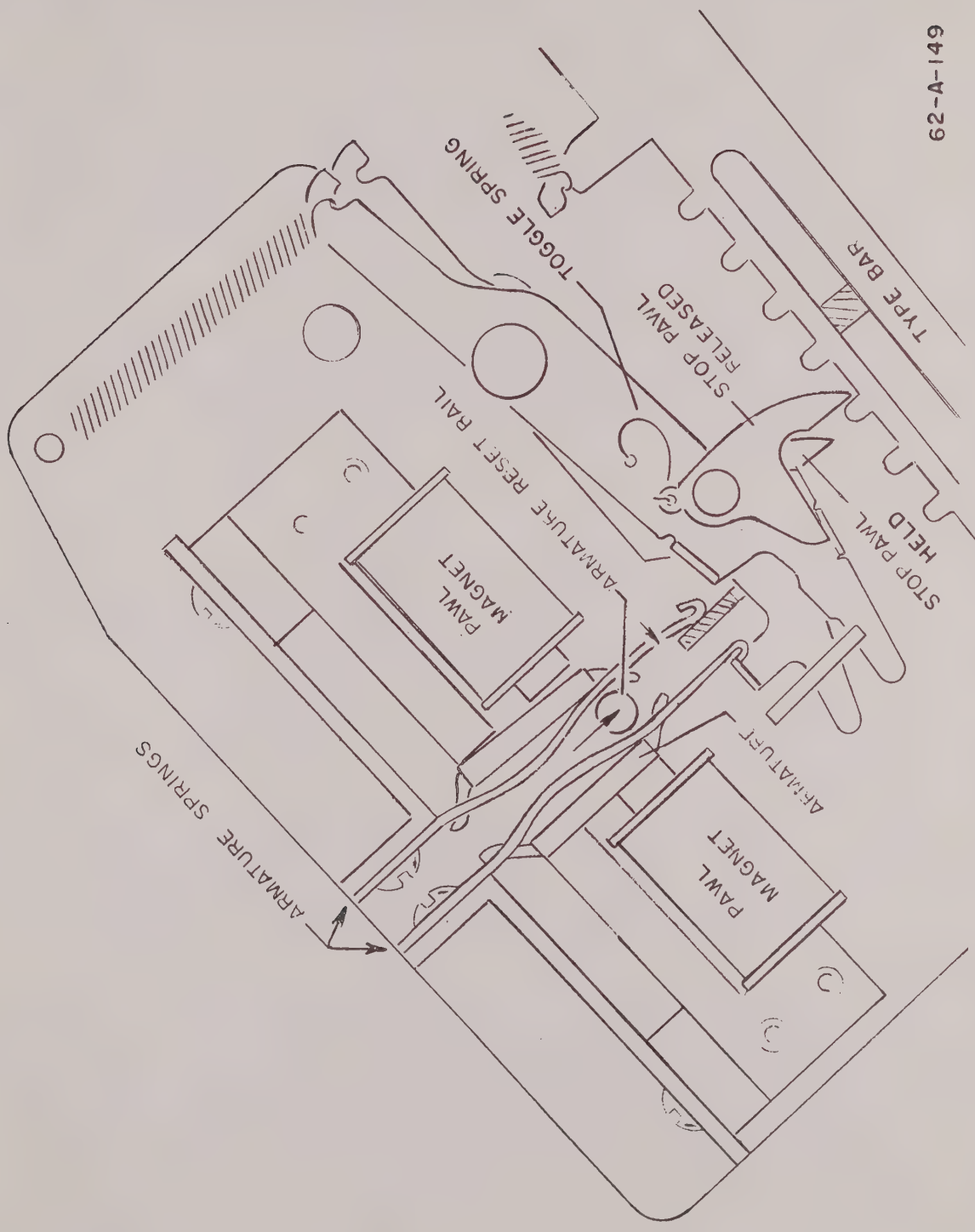


FIG. 3-7 Cross section of the pawl magnet assembly, showing two of the pawl magnets and stop pawls.

Since the type bars are latched in their various decimal positions by stop pawls during indexing, they have to be unlatched during restoration. To permit this, each pawl is hinged backward on its pawl arm, as shown in Figure 3-7, and is snapped out of engagement by a toggle spring when the type bar starts its restoring travel.

Near the end of the cycle, the pawl arms are raised by mechanical linkage, turning the pawls upright. After the pawl arms are fully raised, the armature reset bail presses the magnet armatures against the magnet pole pieces, engaging each armature spring catch under its pawl arm. The bail remains in this position at the end of the cycle, but the pawl arm restoring linkage returns before the end. Because of this two-sequence reset action, the power needed by the magnets can be kept at a minimum: just enough to enable each magnet to hold its armature.

To make sure that the position transducer is in the correct starting position for the next cycle of operation, a reset coil (L102) on the transducer is energized through a cam switch (S103) at the beginning of the restoring action. By locking the transducer reed during restoration, the magnetic field of the coil also saves needless wear of the transducer contacts, thus extending their life.

3.8 CODE GENERATOR

3.8.1 Design of the code Generator. Comprising the position transducer and three binary, or flip-flop, stages (Q101 and Q102, Q103 and Q104, Q105 and Q106), the code generator produces four-line BCD signals representing the decimal position of the type bar assembly.

As shown in Figures 3-8 and 3-9, a diode gate (CR113) and a feedback loop convert what would otherwise be a scale-of-sixteen counter into a decimal counting circuit.

Two diodes, CR110 and CR111, determine the weighting of the four-line code. With the code control line ungrounded, CR110 connects the feedback loop from Q103 to Q102 for a 1-2-2-4 code. When the line is grounded, CR111 switches the loop from Q105 to Q102, changing the weighting to 1-2-4-2 for a 1-2-4-2 or a 1-2-4-8 input code (both of these weights are the same in the logic of the 1453).

3.8.2 The Binary Circuit. A typical binary stage in the code generator is a pair of p-n-p transistor amplifiers with the collector of each coupled to the base of the other. Being symmetrical, the circuit can exist in either of two stable states in which one transistor is conducting while the other is cut off. Figure 3-10 shows one of the binaries and describes how positive pulses from the position transducer switch the circuit from one stable state to the other.

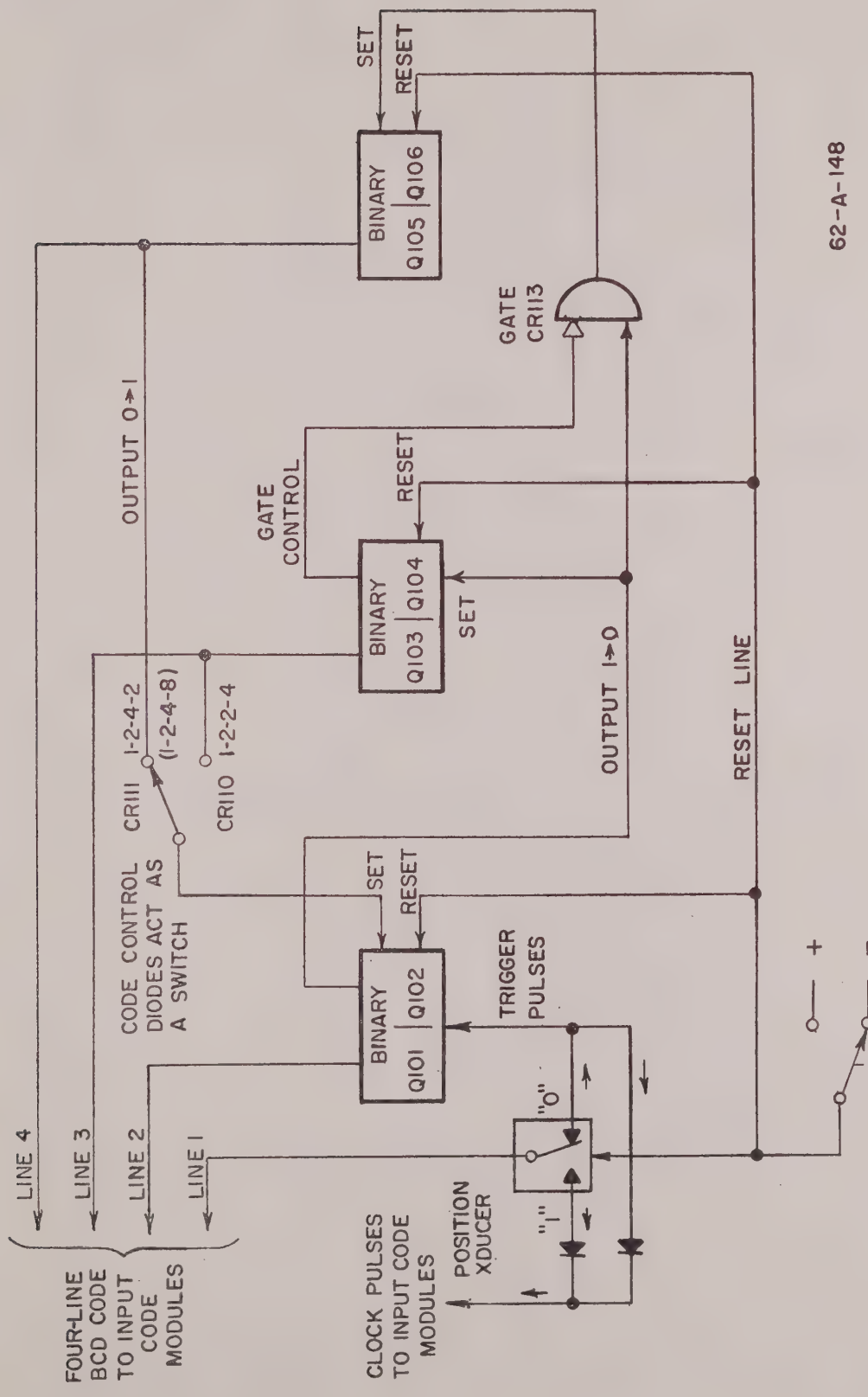


FIG. 3-8 The code generator produces four-line BCD signals representing the decimal position of the type bar assembly. Note that 1-2-4-2 and 1-2-4-8 are the same in this logic.

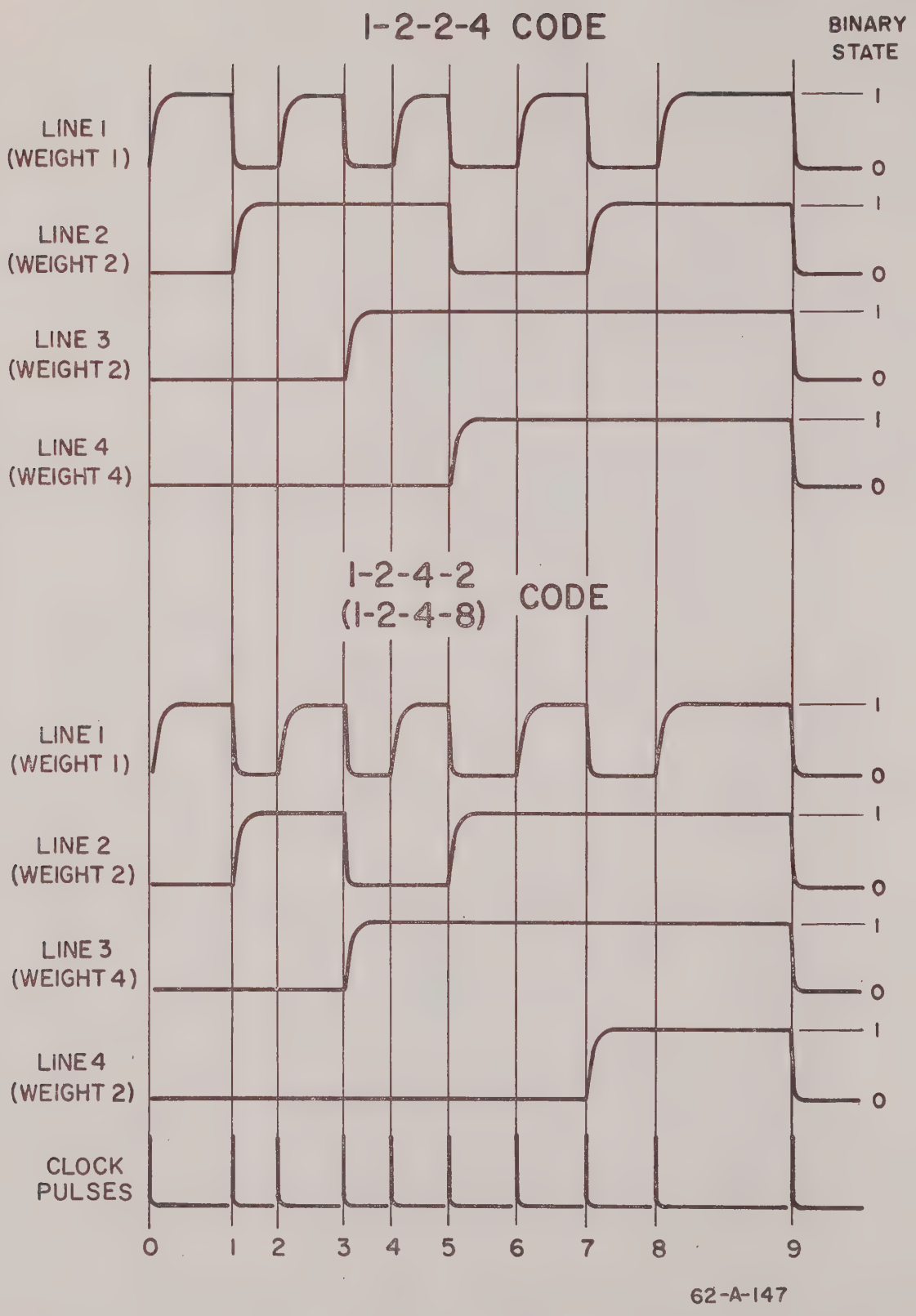


FIG. 3-9. BCD outputs of the code generator. The uneven clock pulse spacing is due to acceleration and deceleration of the printer mechanism.

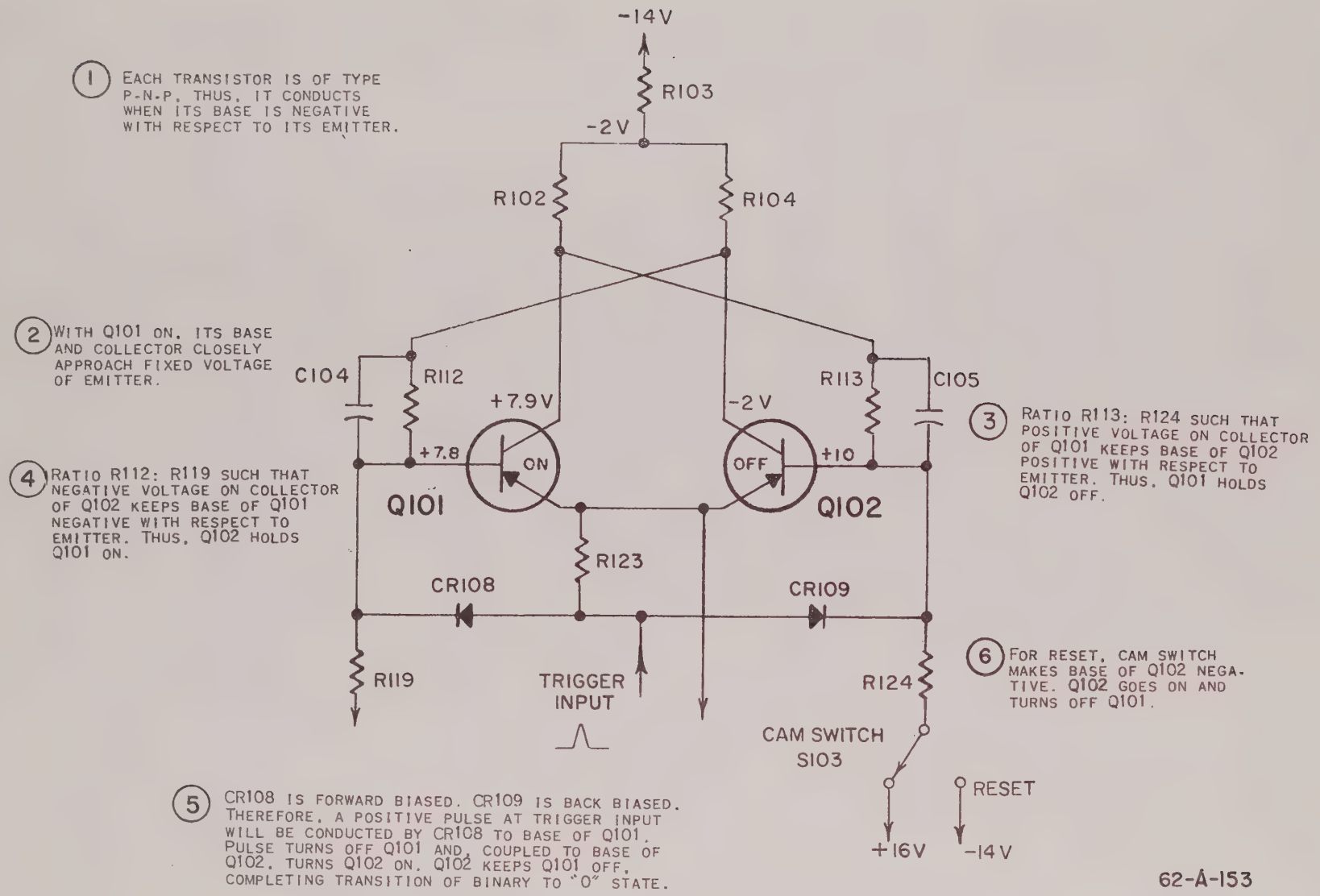

-14V
R103
-2V
R102
R104
C104
R112
+7.9V
-2V
R113
C105
+7.8
ON
OFF
+10
Q101
Q102
R123
CR108
CR109
R119
TRIGGER INPUT
R124
CAM SWITCH S103
RESET
+16V
-14V
62-A-153
1 EACH TRANSISTOR IS OF TYPE P-N-P. THUS, IT CONDUCTS WHEN ITS BASE IS NEGATIVE WITH RESPECT TO ITS EMITTER.
2 WITH Q101 ON, ITS BASE AND COLLECTOR CLOSELY APPROACH FIXED VOLTAGE OF EMITTER.
3 RATIO R113: R124 SUCH THAT POSITIVE VOLTAGE ON COLLECTOR OF Q101 KEEPS BASE OF Q102 POSITIVE WITH RESPECT TO EMITTER. THUS, Q101 HOLDS Q102 OFF.
4 RATIO R112: R119 SUCH THAT NEGATIVE VOLTAGE ON COLLECTOR OF Q102 KEEPS BASE OF Q101 NEGATIVE WITH RESPECT TO EMITTER. THUS, Q102 HOLDS Q101 ON.
5 CR108 IS FORWARD BIASED. CR109 IS BACK BIASED. THEREFORE, A POSITIVE PULSE AT TRIGGER INPUT WILL BE CONDUCTED BY CR108 TO BASE OF Q101. PULSE TURNS OFF Q101 AND, COUPLED TO BASE OF Q102, TURNS Q102 ON. Q102 KEEPS Q101 OFF, COMPLETING TRANSITION OF BINARY TO "0" STATE.
6 FOR RESET, CAM SWITCH MAKES BASE OF Q102 NEGATIVE. Q102 GOES ON AND TURNS OFF Q101.

FIG. 3-10 A typical binary in the code generator. The circuit is shown in the "1" state.

SECTION 4

SERVICING

4.1 PREPARING THE PRINTER FOR SERVICING

4.1.1 Removing the Printer from its Case. To remove the portable case, pull out the catch on each side of the case, near the bottom, then slide the case back and up.

To remove the printer from its rack adapter or bench cabinet, give a quarter turn counterclockwise to the two screws below the paper compartment; then slide the printer forward.

4.1.2 Removing the Printer Mechanism. For most of the mechanical servicing procedures described in this section, you will need to remove the printer mechanism, as shown in Figure 4-1.

4.1.3 Manually Operating the Printer Mechanism. When servicing the printer, it is often necessary to cycle the mechanism by hand, as follows:

1) After removing the mechanism (see Figure 4-1), turn its left side toward you. Between the side plate and the pawl magnet assembly you will find the mechanical trigger shown in Figure 4-2.

2) Press upward the lever indicated in Figure 4-2. The clutch will then engage.

3) To drive the mechanism through one cycle, rotate the large nylon gear in the gear train counterclockwise (the gear engages with the drive motor pinion).

4.2 TROUBLESHOOTING

4.2.1 Aids to Troubleshooting. A good first step in troubleshooting the printer is to study Section 3, as well as the Timing Diagram in the schematic section, so as to gain a thorough understanding of the circuit logic. Refer then to Section 4.3, which summarizes possible troubles and their causes.

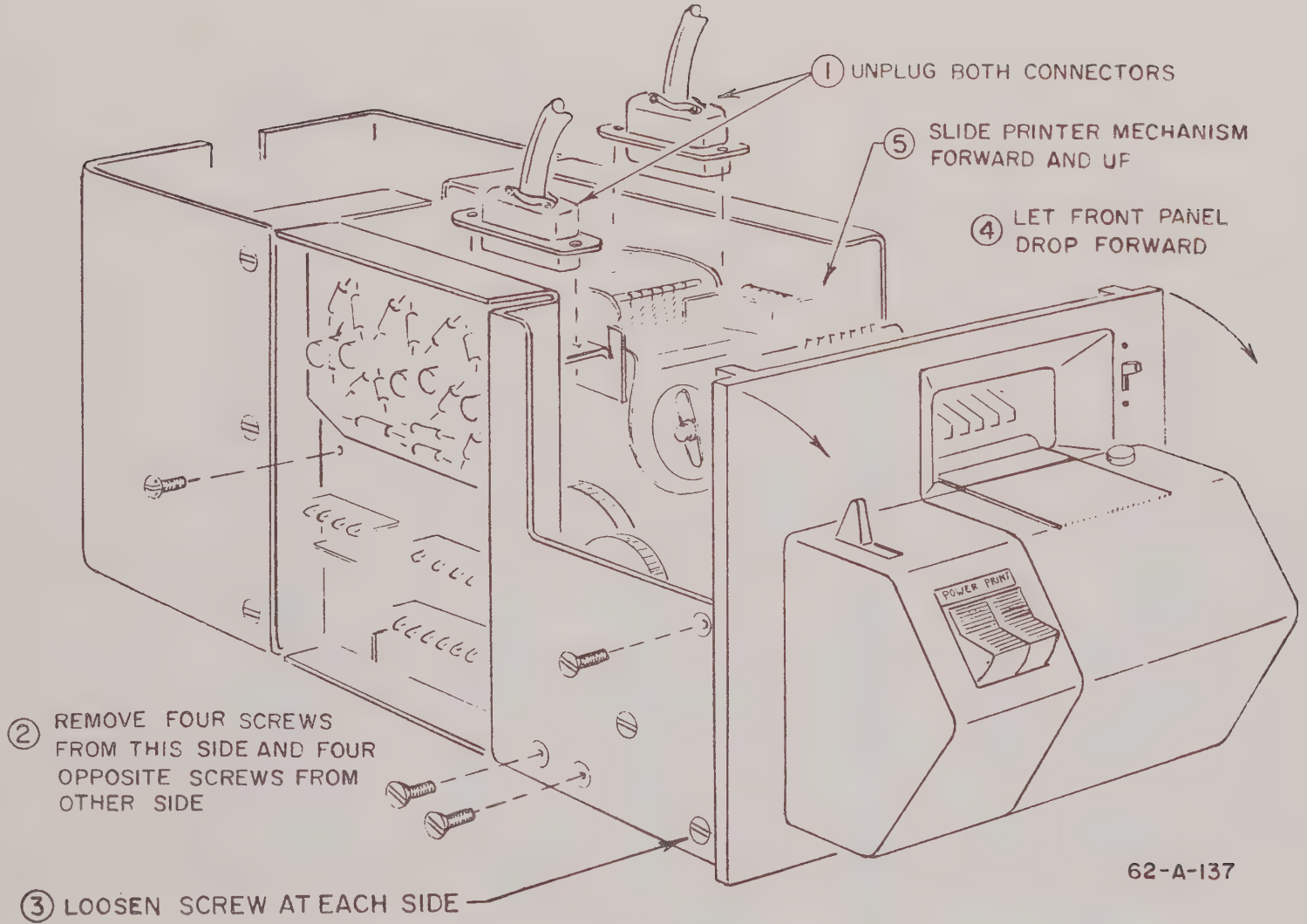

1 UNPLUG BOTH CONNECTORS
5 SLIDE PRINTER MECHANISM FORWARD AND UP
4 LET FRONT PANEL DROP FORWARD
POWER PRINT
2 REMOVE FOUR SCREWS FROM THIS SIDE AND FOUR OPPOSITE SCREWS FROM OTHER SIDE
62-A-137
3 LOOSEN SCREW AT EACH SIDE

FIG. 4-1 To remove the Printer mechanism from the rest of the Printer, follow the steps shown.

4.3 POSSIBLE FAULTS IN OPERATION

4.3.1 Print Command does not Start Cycle. If a print command does not start a printing cycle, follow this procedure:

1) Make sure that the print switch is in the PRINT position.

2) See whether the print command is reaching the control trigger circuit. Watch the color selector, K102. Even with the print switch at "standby", K102 should be energized when the print command line is negative, and de-energized when the line is positive.

3) Measure the voltage at pin 7 of V101. It should be identical to the print command line input.

4) Continuity-check the print command line up to pin 5 of connector "C".

5) Check the cam switch adjustment as described in Section 4.4.3.

6) Measure the signal at the collector of Q107. The collector should be at ground when the print command line is negative, and at -28 volts when the line is positive.

7) Replace V101.

8) Check Q107. First, connect pin 8 of V101 to +16 volts: the collector should be negative. Next, remove V101: the collector should be between -10 volts and ground. If not, replace Q107.

9) Check the clutch actuator driver, Q108. First, using a scope, see what happens at the collector of Q108 when a print command occurs: the collector must move to ground for at least 20 milliseconds. If it does not, contacts on K103C (Fig. 3-4) may need adjustment or or cleaning; Q108 or T102 may be defective.

10) See whether K103 is being actuated. Ground the collector of Q108 through a 100 ma meter: the clutch should operate the mechanism continuously with a current of 80 ma flowing. If current does not flow, the winding of K102 is open, or there is a break in the wiring to K103. If current is flowing and K103 is energized, the clutch actuating mechanism is out of adjustment.

4.3.2 Single Print Command Produces more than One Cycle. When a single print command produces more than one cycle of operation, the cause may be electrical or mechanical. To find the cause, go through this procedure:

1) While the mechanism is in one of the unwanted cycles, press the PRINT switch to "standby". If the printer stops at the end of that cycle, the problem is electrical.

2) With the POWER switch off, cycle the mechanism by hand while watching the operating sequence of the type alignment bar and the reset contacts (the lower set) on the cam switch. The contacts must be fully closed and separated from the cam one half turn of the plastic gear before the type alignment bar touches the clutch actuator. To adjust the timing, see Section 4.4.3.

3) Repeat step 1. If K103 is energized and switching to standby does not stop operation, either the type alignment bar does not press the armature of K103 far enough to break the latching contacts, or Q108 has excessive collector leakage. First, pull out connector P102 (at left front of mechanism) to stop the motor. Give a single print command to energize K103, then operate the mechanism by hand until the type alignment bar presses the armature of K103. The motion should be enough to press the armature against the frame of the magnet, releasing the magnet, which should then remain de-energized.

   If the mechanical action is correct, remove connector P101 (on the pawl magnet assembly) and press the PRINT switch to "standby" (IMPORTANT) to prevent actuation of Q108. Place a milliammeter between the collector of Q108 and the -28 volt supply to determine leakage. At high line voltage (135 volts rms) the leakage must not exceed 50 microamps at 25° C. If greater, replace Q108.

4) Repeat step 1. If the clutch actuator is de-energized and the cycle continues, turn off the printer and check the adjustment of the clutch control eccentric, as described in Section 4.4.1 If this appears correct, try increasing the spring tension on the clutch trigger by pulling the spring sideways (the spring runs from the trigger to the actuator frame). If operation improves, shorten the spring slightly, but make sure that the mechanism works well at low line voltage (95 volts rms).

4.3.3 One or More Columns do not Print. If one or more columns wrongly produce a blank impression, follow these steps:

1) Make sure that no modules are upside down or loose in their sockets.

2) Rule out the possibility of a defective module by replacing the suspected module with one from a correct column.

3) Check whether the input data are changing after the print command. They should not.

4) Remove the input connector from the module in the faulty column, then operate the printer. The column should print a random number. If it produces a blank impression, the pawl magnet for that column may be out of position. Adjust the magnet as described in Section 4.4.4.

4.3.4 No Columns Print If all columns wrongly produce a blank impression, follow these steps:

1) Measure all supply voltages to rule out failure of the power supply.

2) Check the reset line: it should be at -14 volts when the mechanism is in the rest position. Reset failure may be due to wrong adjustment of the cam switch. Figure 4-4 shows the correct adjustment.

3) Make sure that the input data do not change after print command.

4) Inspect the pawl magnet assembly: the mechanism may be jammed so that the stop pawls do not reset. Operate the mechanism by hand, making sure that the pawl reset link (right side, internal) advances and suddenly retracts near the end of the cycle, actuating the pawl reset bail. The overtravel spring should not operate.

5) The pawl reset link may not be in place on the cam actuating lever. Replace the link over the end of the lever. Then check that there is a small coil spring running down and back from the lever to the side plate. If the spring is missing, replace it.

4.4 MECHANICAL ADJUSTMENTS

4.4.1 Clutch Control Eccentric. When a single print command produces more than one cycle of operation, the clutch control eccentric may be out of adjustment. If the troubleshooting procedure in Section 4.3.2 indicates that this eccentric needs adjustment, follow these steps while referring to Figure 4-2.

1) Manually operate the printer through one cycle until the clutch slide has moved to its most rearward position.

2) Loosen the clamping nut.

3) Turn the eccentric so that the clutch trigger engages with a minimum of overtravel of the clutch slide. Movement of the slide from its extreme position to its normal cocked position should be less than .030 in.

4.4.2 Clutch Slide Eccentric. The clutch slide eccentric should be adjusted after the clutch control eccentric (see Section 4.4.1). Make the adjustment so that .005 in. interference occurs between the eccentric and the spring loaded lever that bears on it, as shown in Figure 4-3.

4.4.3 Cam Switch. You can adjust the cam switch timing by moving the cam on its shaft. To make this adjustment, refer to Figure 4-4 and follow these steps:

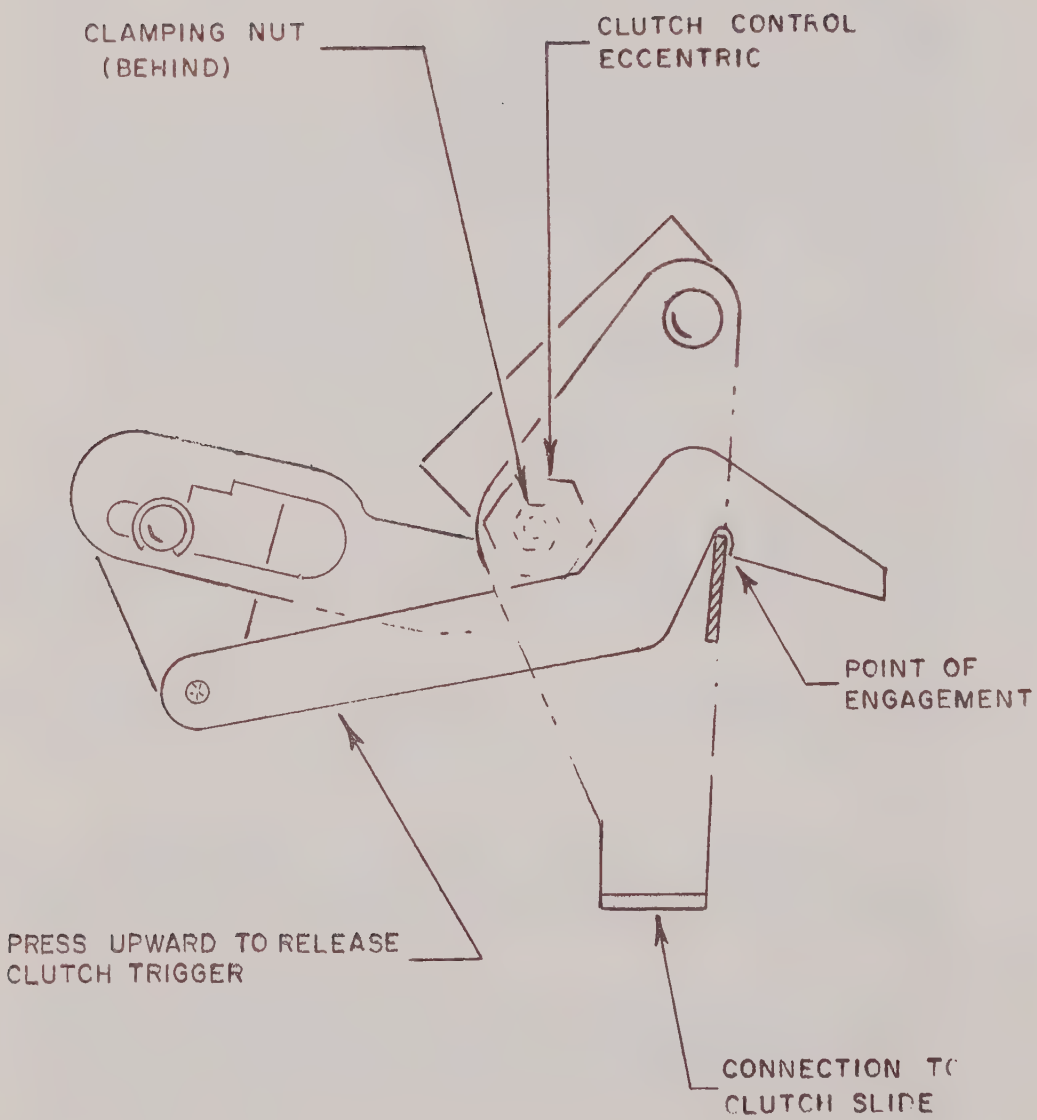


FIG. 4-2 To adjust the clutch control eccentric, follow the steps in Section 4. 4. 1 while referring to this illustration.

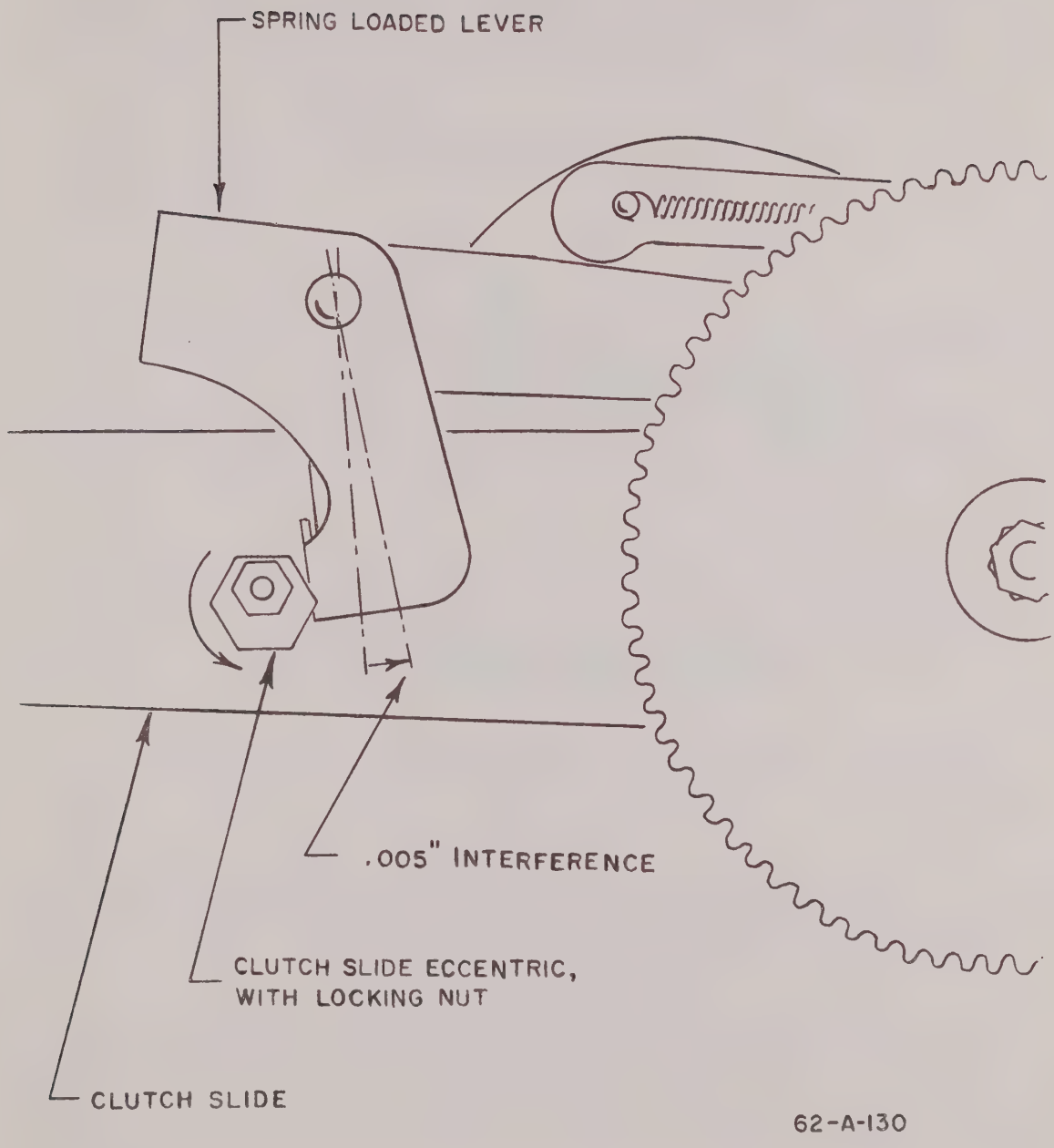


FIG. 4-3 The clutch slide eccentric is adjusted as described in Section 4.4.2.

1) Loosen the lock nut and the clamping nut.

2) Rotate the cam so that in the normal rest position the cam clears the follower leaf by .010 to .020 in. Correct adjustment is shown when the reset contacts do not open with normal overtravel of the shaft but open before the excursion control bar begins to move as the machine is cycled.

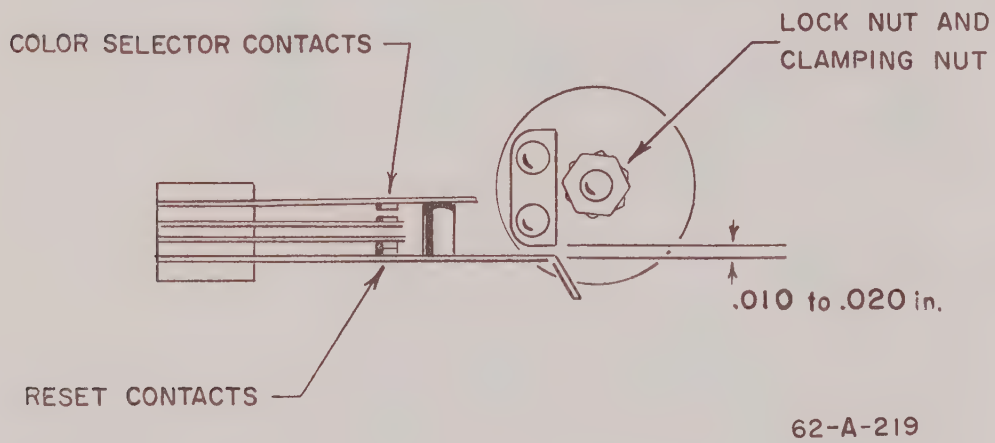


FIG. 4-4 Correct adjustment of the cam switch at the normal rest position (see Section 4.4.3).

4.4.4 Pawl Magnet Position. Located on top of the type bars, the pawl magnet assembly comprises either 8 or 12 pawl magnets arranged in pairs as shown in Figure 4-5 (See Figure 3-7 also). Each pair is held to the magnet frame by two screws, each in a slot.

If the trouble shooting procedure in Section 4.3.3 indicates that a pawl magnet is out of position, follow these steps while referring to Figure 4-5.

1) Loosen, but do not remove, the pair of screws holding the suspected magnet.

2) With power off and the mechanism in the rest position, gently move the magnet until you feel it touch the armature.

3) See that both magnets of the pair are properly centered on their armatures. The illustration shows right and wrong adjustments. Clearance between the magnet cores and the armatures should be essentially zero in the reset (rest) position, but no significant force should be exerted on the armatures by the cores.

4) Tighten the clamping screws.

5) Make sure the machine is printing correctly, then lock the screws with Glyptol or a similar substance.

4.5 LUBRICATION PROCEDURE

4.5.1 General Procedure. To keep the Printer in good running order, lubricate the mechanism every 500,000 impressions, or every six months.

Before applying the lubricants, carefully clean the bearings and surfaces. Since oil dissolves grease, you should make sure that oil does not run onto greased surfaces. Therefore, oil first (Section 4.5.2), wipe off all excess, then apply grease (Section 4.5.3).

4.5.2 Oiling. Mechanical parts with enclosed bearing surfaces need lubrication with a good grade of light machine oil at the interval stated in Section 4.5.1. Included in these parts are levers and rollers on shafts, as well as sliding members in close fitting guides.

4.5.3 Greasing. At the interval stated in Section 4.5.1, apply a high grade grease, such as Lubriplate No. 2, to cam surfaces, loose-fitting sliding members, gear teeth, and the needle bearing of the main camshaft.

The bearings of the drive motor are packed and sealed at the factory and require no maintenance.

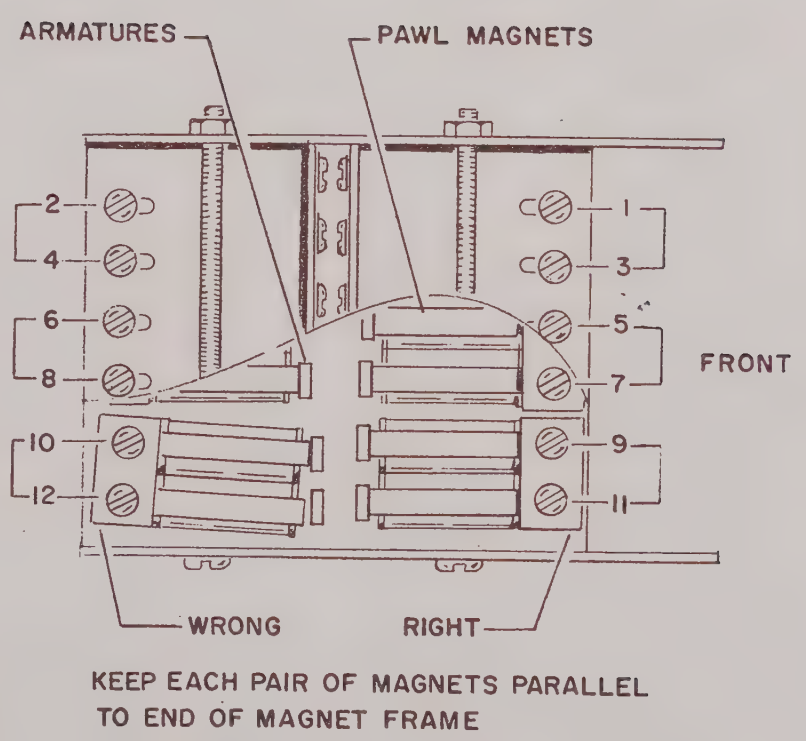


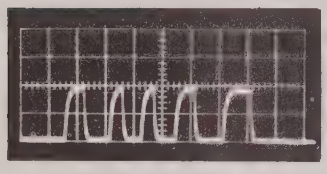
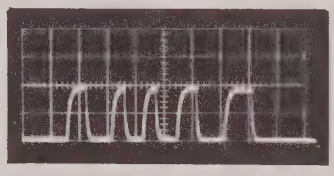
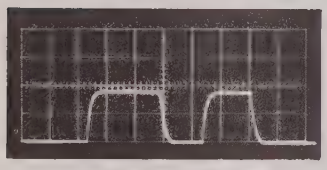
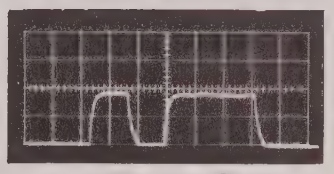
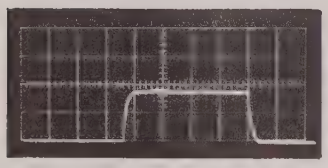
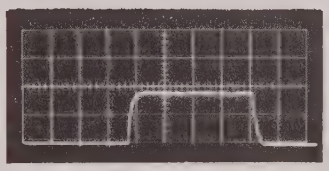
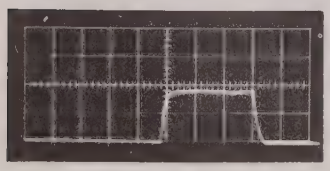
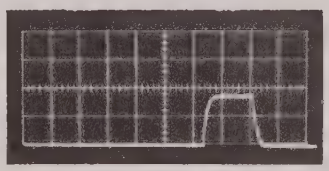
FIG. 4-5 Internal arrangment of the pawl magnet assembly as seen from above the Printer (for a side view of the assembly, see Figure 3-7). The numbers 1 through 12 correspond to the digit columns, reading from right to left across the paper tape. To adjust a magnet position, follow the steps in Section 4. 4. 4.

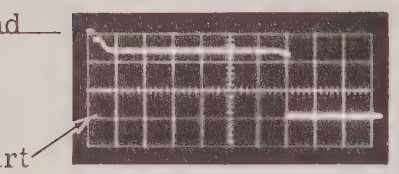
TYPICAL WAVEFORMS

Oscilloscope used: Tektronix Model 531 with type CA Preamplifier.
All signals dc coupled.

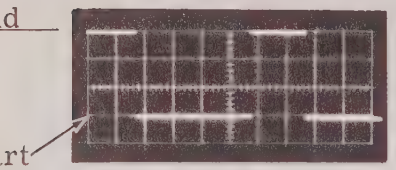
CODE GENERATOR OUTPUTS

Vertical Scale: 5v/div.
Time Scale: 10 millisec/div.
Test Points: Any Input Module socket (P202) provides all test points.
Synchronization: Positive sync. on reset line, P202, pin 7.

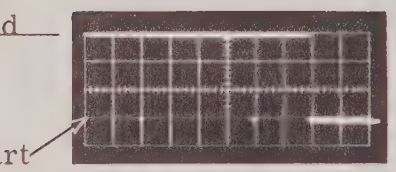
1-2-2-4 Code		1-2-4-2 (1-2-4-8) Code	
	Gnd		Line 1 (1st bit): binary pulse output of Position Transducer. P202, pin 1
Weight 1		Weight 1	
	Gnd		Line 2 (2nd bit) P202, pin 2
Weight 2		Weight 2	
	Gnd		Line 3 (3rd bit) P202, pin 4
Weight 2		Weight 4	
	Gnd		Line 4 (4th bit) P202, pin 6
Weight 4		Weight 2	
	Gnd		Clock pulse output of Position Transducer. P202, pin 5 Both waveforms are identical. In the right-hand picture, the scale has been extinguished for clarity
0 1 2 3 4 5 6 7 8 9		0 1 2 3 4 5 6 7 8 9	



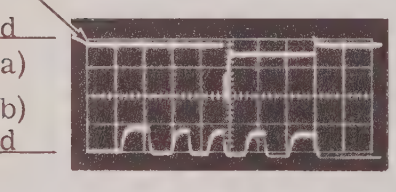
Signal: Clutch actuation voltage
Test Point: Q108, collector
Scales: 10v/div., 20 millisec/div.
Sync: Positive, on signal



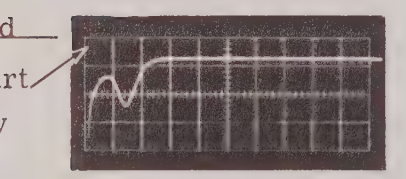
Signal: Color control, red
Test Point: Q107, collector
Scales: 10v/div., 20 millisec/div.
Sync: Positive, on Q108 collector



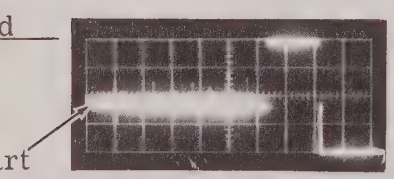
Signal: Color control, black
Test Point: Q107, collector
Scales: 10v/div., 20 millisec/div.
Sync: Positive, on Q108 collector



Signal: a) Pawl magnet voltage, digit "5"
b) Position Transducer output
Test Point: a) P202, pin 9; b) P202, pin 1
Scales: a) 20v/div., 10 millisec/div.
b) 10v/div., 10 millisec/div.
Sync: Positive, on reset line (P202, pin 7)



Signal: Pawl magnet voltage
Test Point: P202, pin 9
Scales: 20v/div., 1 millisec/div.
Sync: Negative, on signal



Signal: Coincidence output, digit "7"
Test Point: Q201, base
Scales: 2v/div., 10 millisec/div.
Sync: Positive, on reset line (P202, pin 7)

MODIFICATION H

Printers with this modification are designed to operate on a line voltage of 230 volts ac, which must be 50 cps. As shown in the box on the Master Schematic Diagram, the modification comprises the following changes:

1) Power transformer T101 is replaced by a transformer with a 230 volt, 50 cps primary, tapped at 117 volts and 126 volts.

2) Line fuses F101 and F102 have one half the current rating of those in the unmodified Printer.

3) The 60 cps drive motor (B101) is replaced by a 50/60 cps motor, wired to the 117 volt tap.

To operate the Printer on 117 volts or 126 volts (at 50 cps only), remove the wire that connects F101 to the 230 volt tap on the transformer, leaving the motor wiring undisturbed. Then connect the loose wire to the appropriate tap. Also, change F101 and F102 to 1.5 amp Slo-Blo fuses.

MODEL 507 STORAGE UNIT

When fitted with the Model 507 Storage Unit, the printer uses fan-folded paper tape instead of rolls. To insert the paper tape, follow these steps:

1) Remove the upper tray. (Press its sides, then pull.)

2) Lay the tape in the lower tray.

3) Bend the end of the paper up toward you, then fold it sharply across to make a straight leading edge.

4) Feed the end into the paper guide below the platen (the rubber roller).

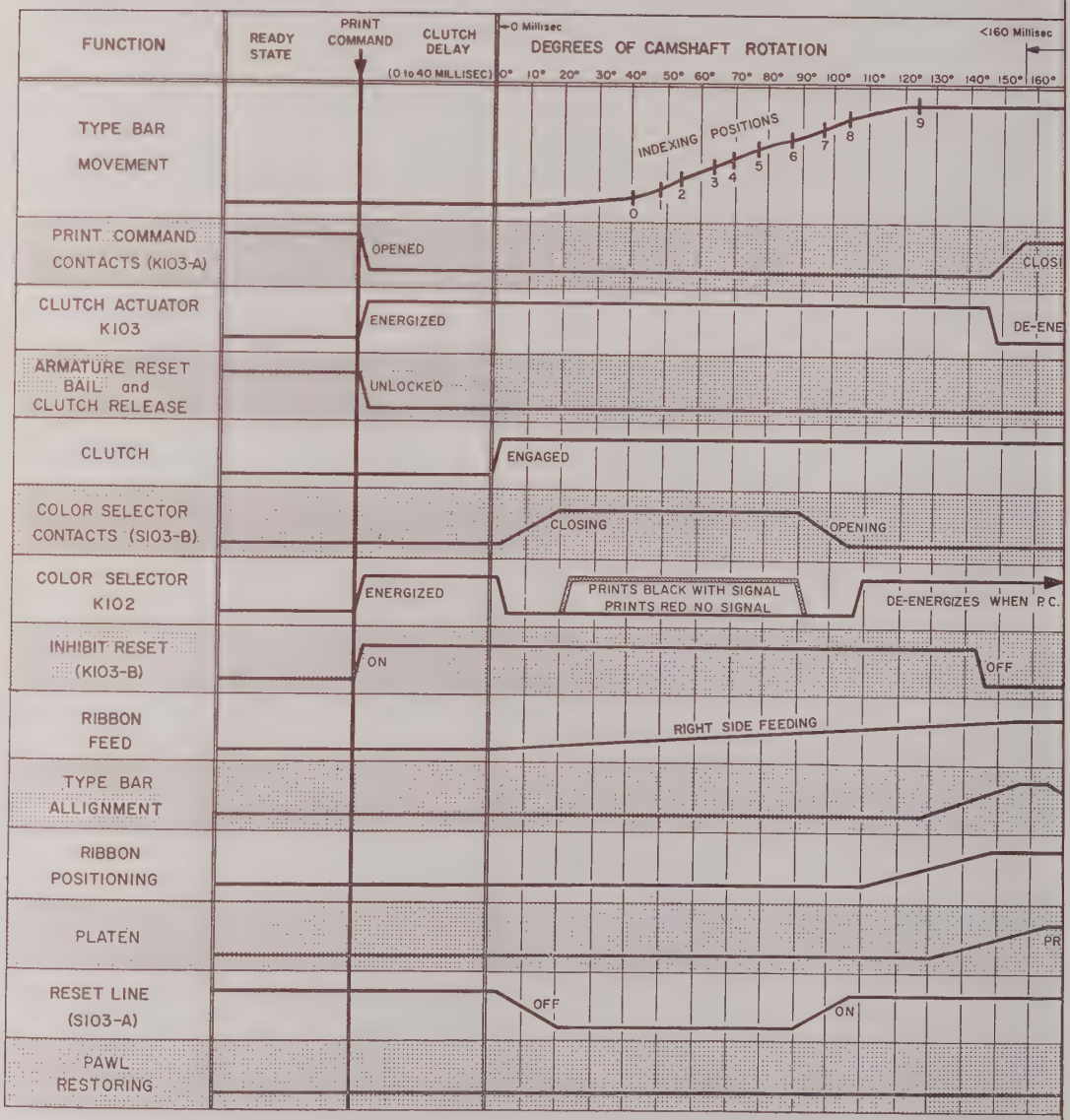
5) Move the paper advance lever several times until the paper appears in the outlet, making sure that the paper is between the inked ribbon and the platen.

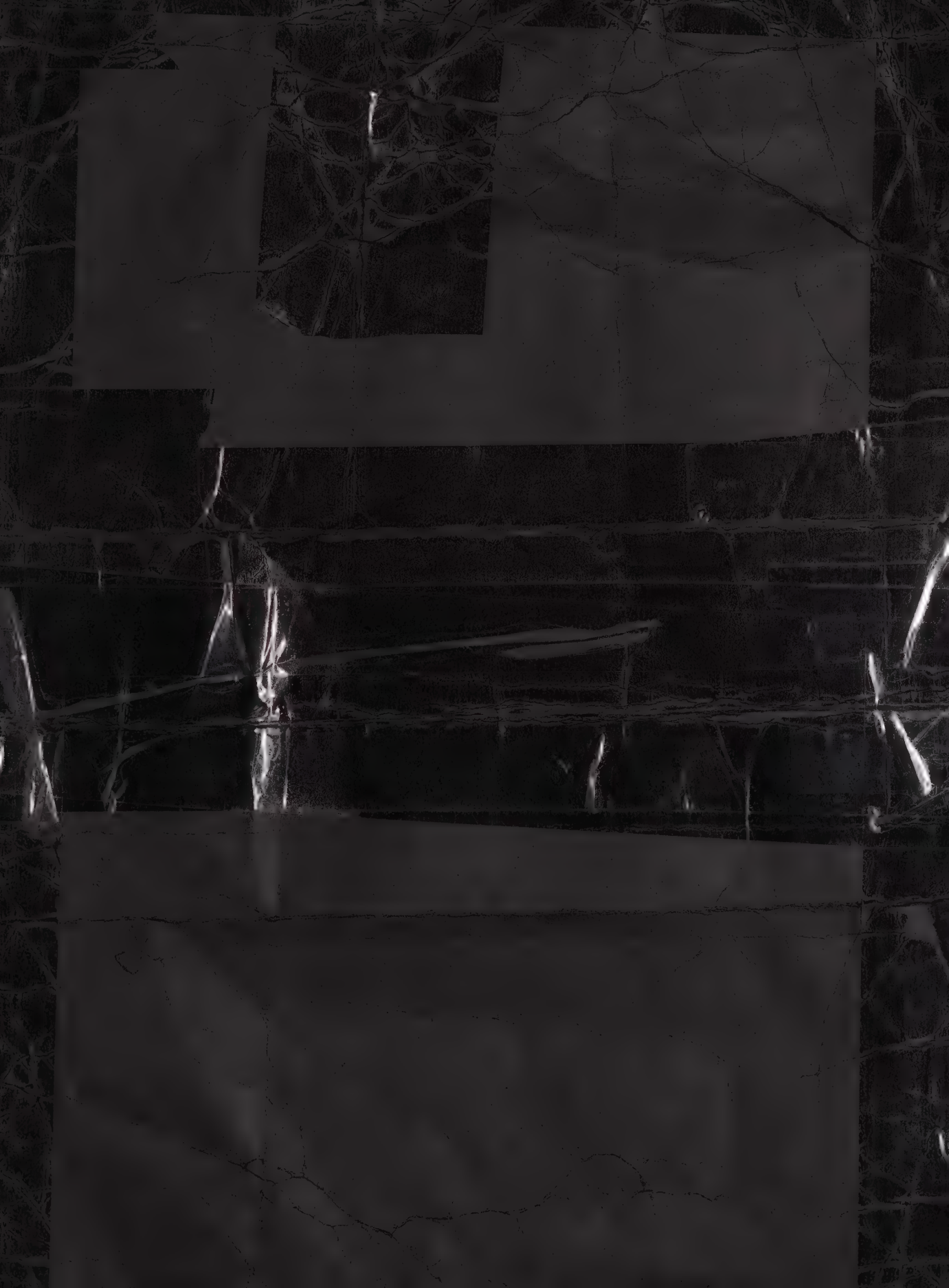
6) Insert the upper tray.

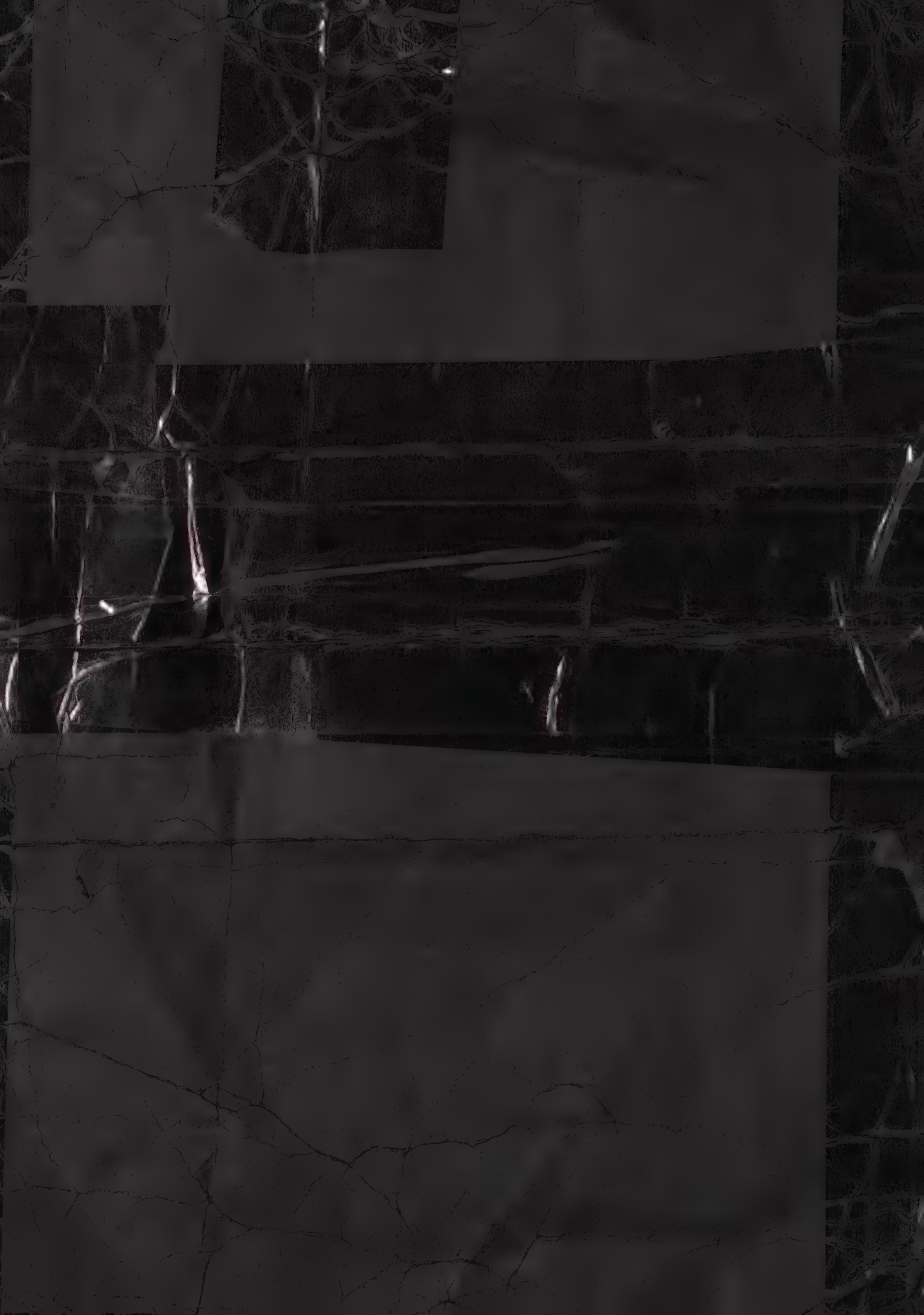
7) Pressing the paper release button, pull out enough paper to feed into the upper tray.

August 1963

BECKMAN INSTRUMENTS, INC. - BERKELEY DIVISION

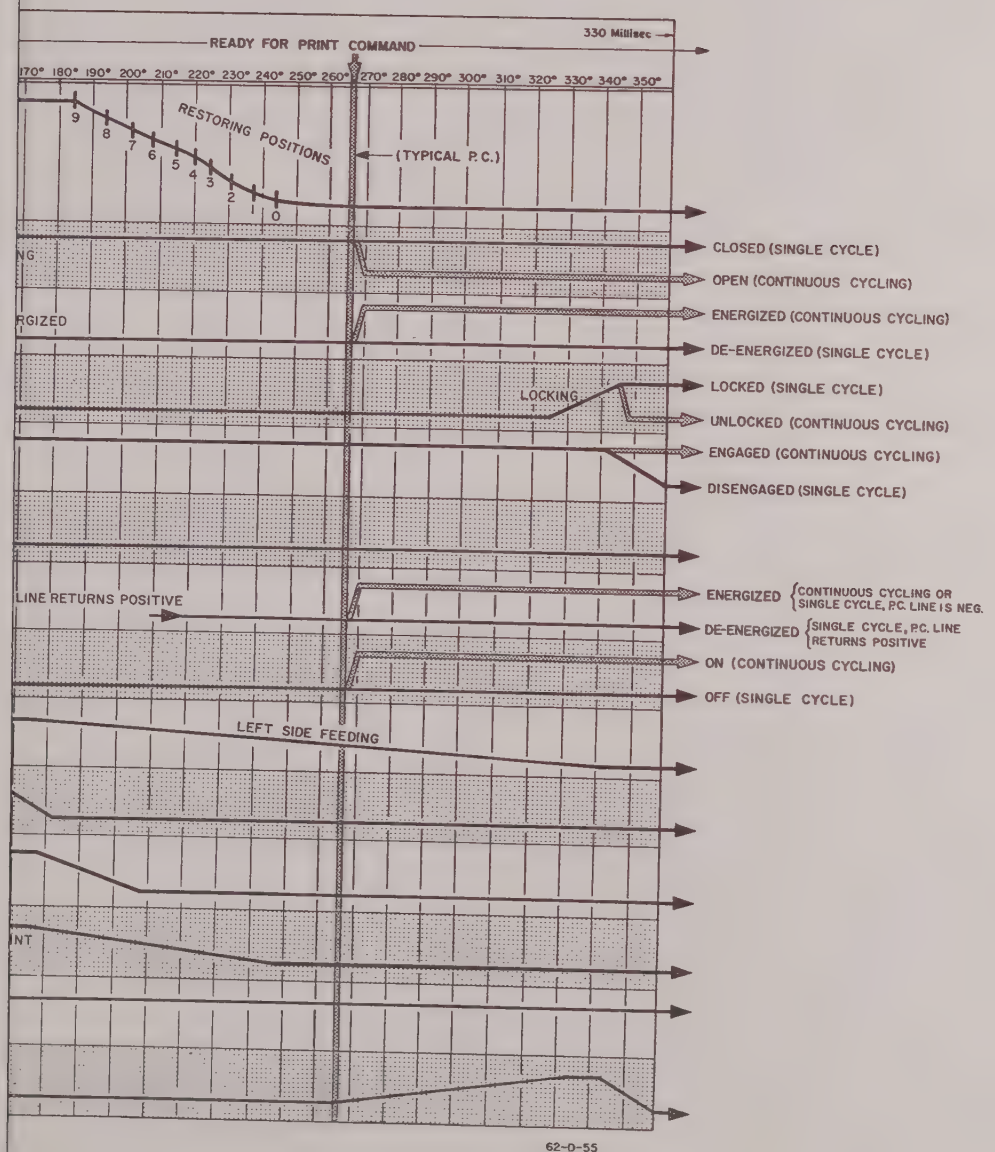

FUNCTION
READY STATE
PRINT COMMAND
CLUTCH DELAY
(0 to 40 MILLISEC)
0 Millisec
DEGREES OF CAMSHAFT ROTATION
<160 Millisec
0° 10° 20° 30° 40° 50° 60° 70° 80° 90° 100° 110° 120° 130° 140° 150° 160°
TYPE BAR MOVEMENT
INDEXING POSITIONS
0 1 2 3 4 5 6 7 8 9
PRINT COMMAND CONTACTS (K103-A)
OPENED
CLOSI
CLUTCH ACTUATOR K103
ENERGIZED
DE-ENE
ARMATURE RESET BAIL and CLUTCH RELEASE
UNLOCKED
CLUTCH
ENGAGED
COLOR SELECTOR CONTACTS (S103-B)
CLOSING
OPENING
COLOR SELECTOR K102
ENERGIZED
PRINTS BLACK WITH SIGNAL
PRINTS RED NO SIGNAL
DE-ENERGIZES WHEN P.C.
INHIBIT RESET (K103-B)
ON
OFF
RIBBON FEED
RIGHT SIDE FEEDING
TYPE BAR ALLIGNMENT
RIBBON POSITIONING
PLATEN
PR
RESET LINE (S103-A)
OFF
ON
PAWL RESTORING





BECKMAN INSTRUMENTS, INC. - BERKELEY DIVISION

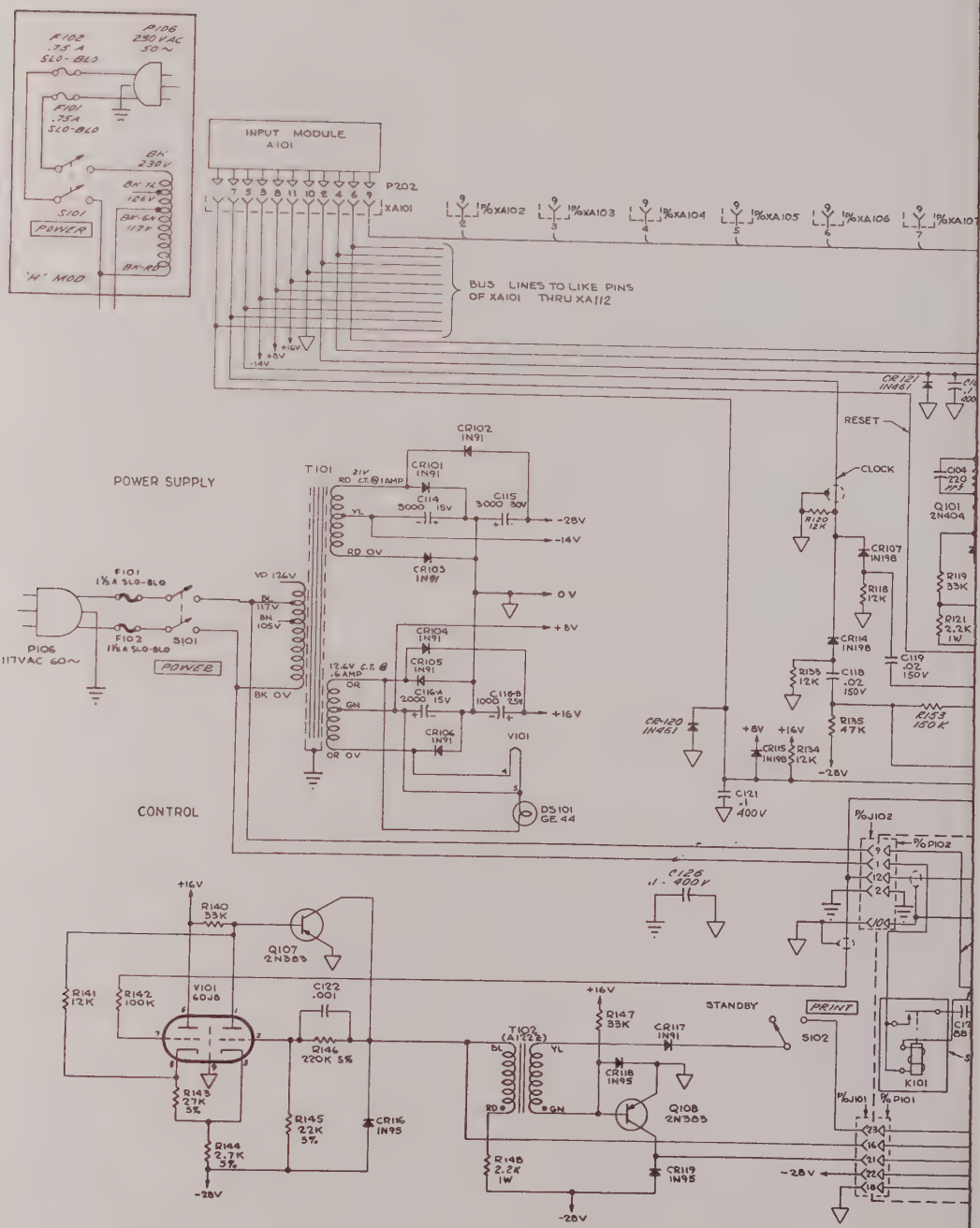
TIMING DIAGRAM

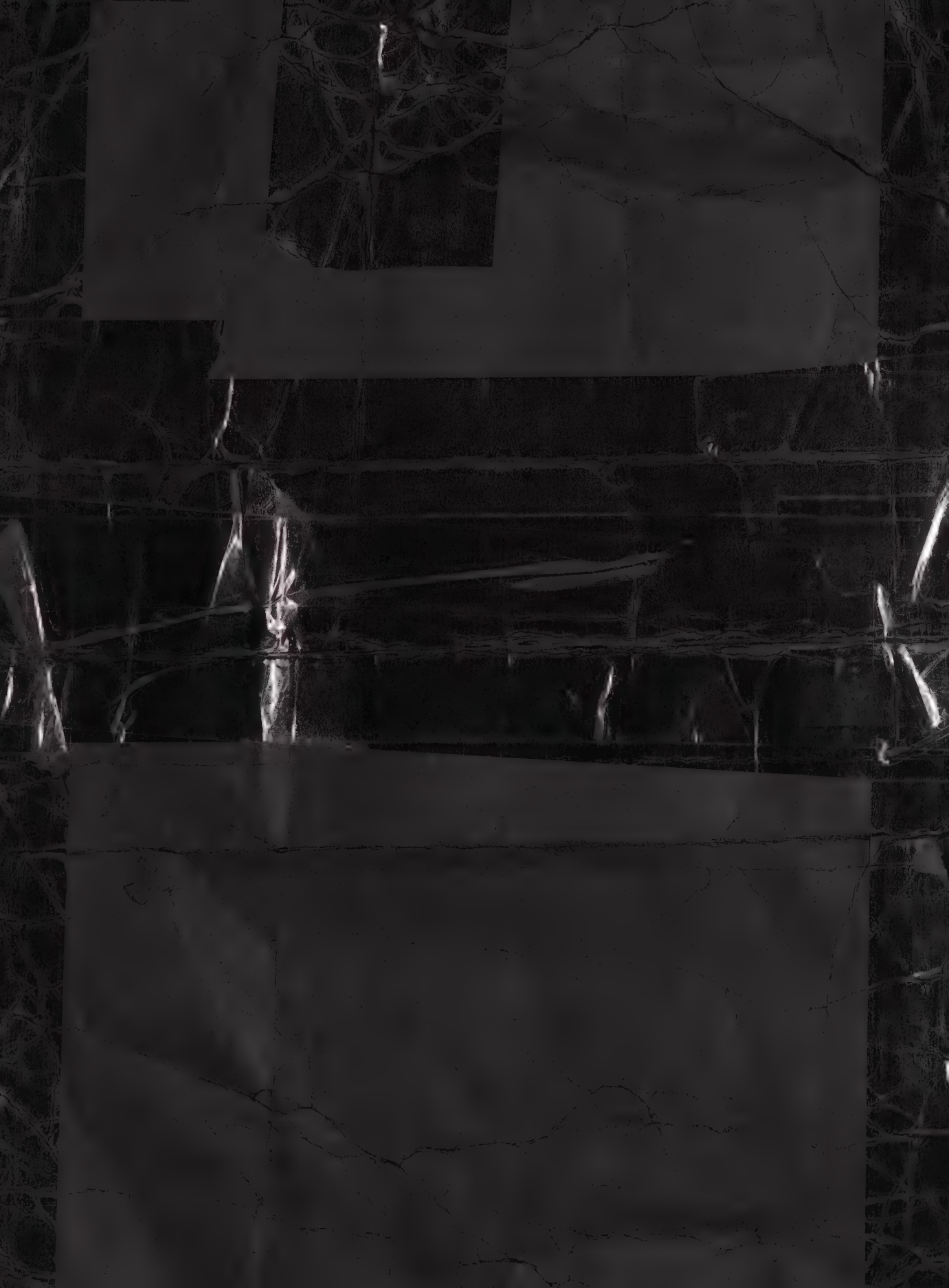


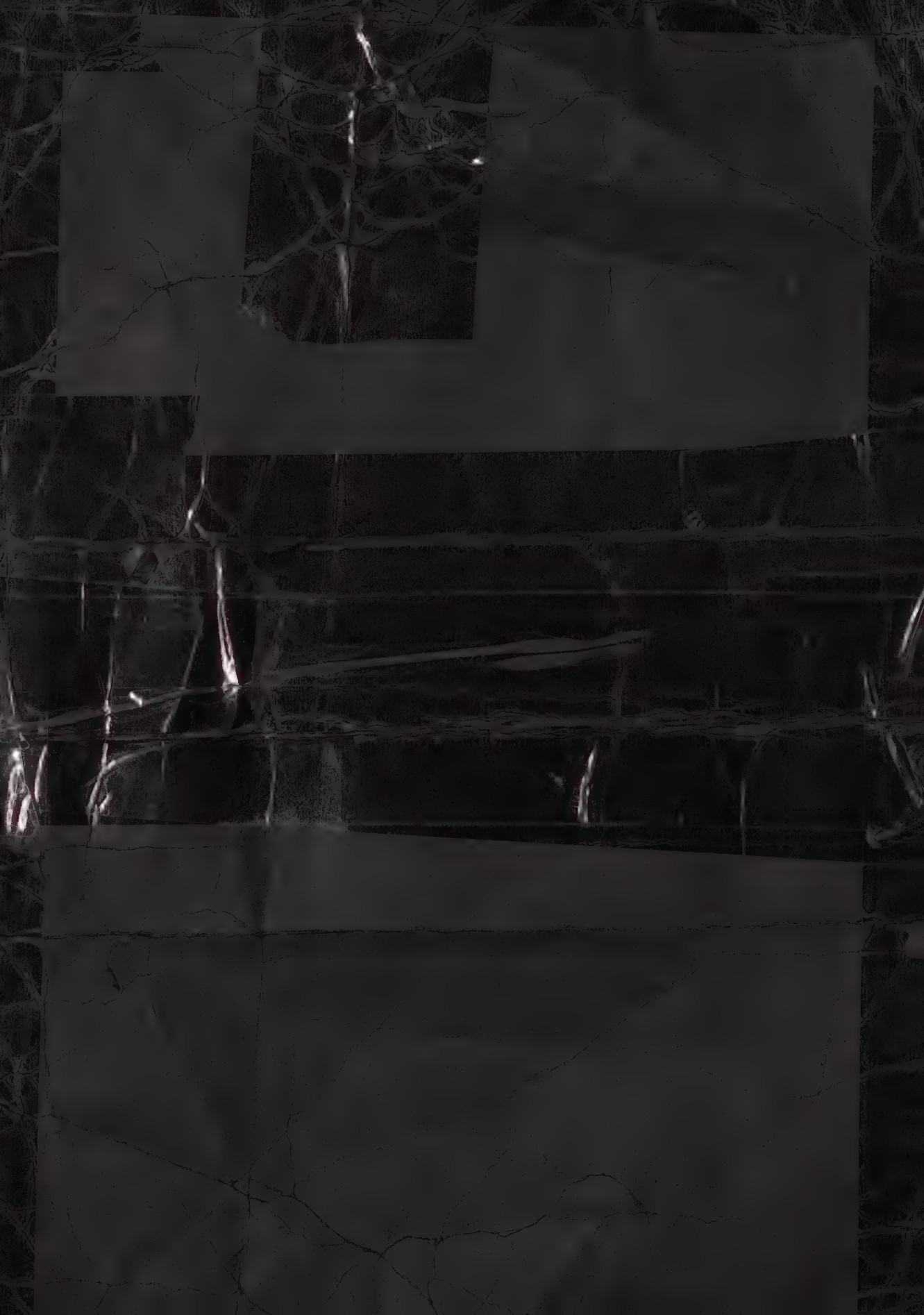
Beckman®

August 1963

BECKMAN INSTRUMENTS, INC. - BERKELEY DIVISION

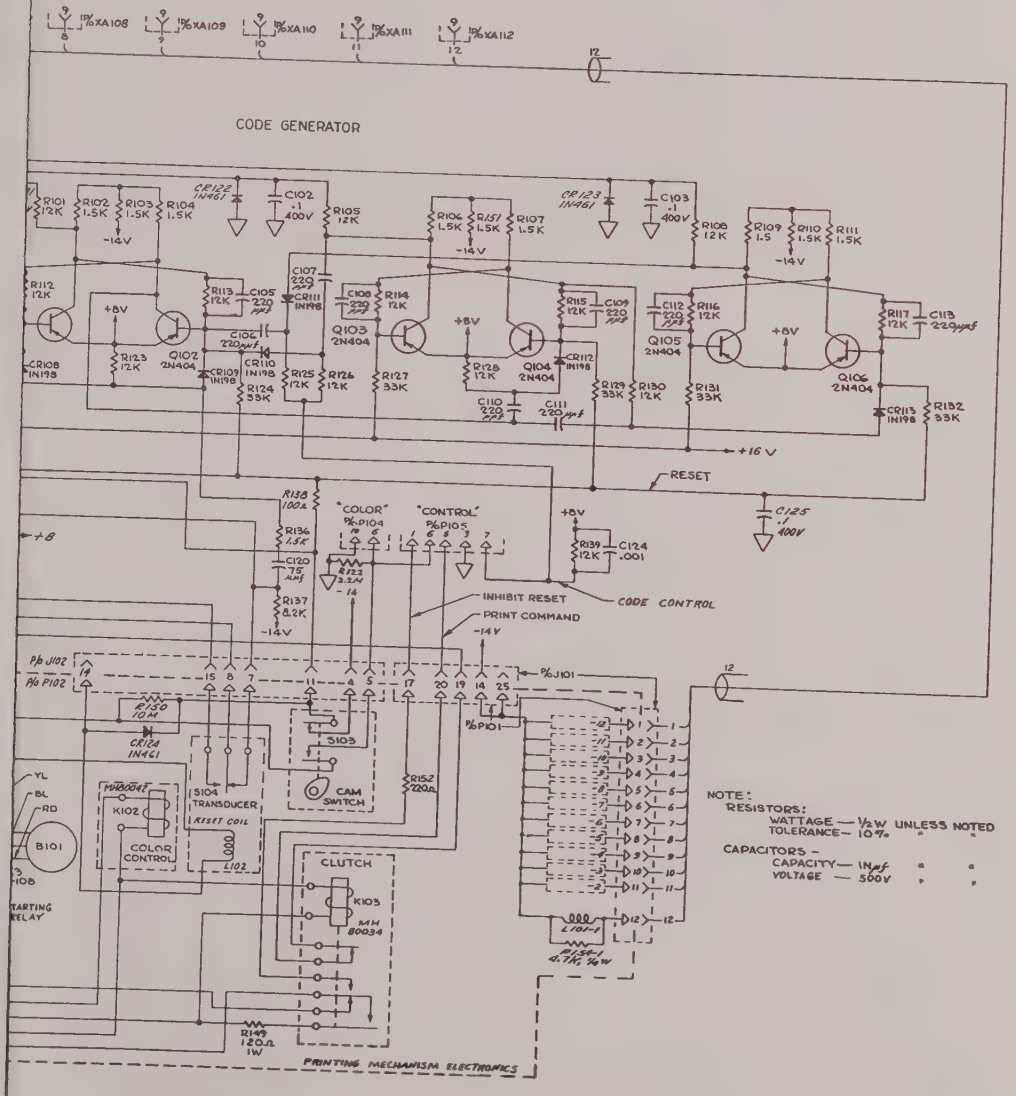

F102 .75 A SLO-BLO
P106 230 VAC 50~
F101 .75A SLO-BLO
BK 230V
BK-YL 126V
BK-GN 117V
S101 POWER
BK-RD
'H' MOD
INPUT MODULE A101
P202
XA101
%XA102
%XA103
%XA104
%XA105
%XA106
%XA107
BUS LINES TO LIKE PINS OF XA101 THRU XA112
+16V
+8V
-14V
POWER SUPPLY
T101
21V CT @1AMP
CR101 1N91
CR102 1N91
CR103 1N91
CR104 1N91
CR105 1N91
CR106 1N91
C114 3000 15V
C115 3000 30V
C116A 2000 15V
C116B 1000 25V
YL
RD 0V
BK 0V
OR
GN
OR 0V
12.6V C.T. @ .6AMP
-28V
-14V
0V
+8V
+16V
F101 1½A SLO-BLO
F102 1½A SLO-BLO
P106 117VAC 60~
S101
POWER
VO 126V
BK 117V
BN 105V
CONTROL
V101
DS101 GE 44
RESET
CLOCK
Q101 2N404
R120 12K
CR107 1N198
R118 12K
CR114 1N198
R119 33K
R121 2.2K 1W
C119 .02 150V
R133 12K
C118 .02 150V
R123 150K
CR120 1N461
CR115 1N198
R134 12K
R135 47K
C121 .1 400V
C126 .1 400V
%J102
%P102
R140 33K
Q107 2N3823
R141 12K
R142 100K
C122 .001
R146 220K 5%
R143 27K 5%
R144 2.7K 5%
R145 22K 5%
CR116 1N95
T102 (A1122)
R147 33K
CR117 1N91
CR118 1N95
Q108 2N3823
R148 2.2K 1W
CR119 1N95
STANDBY
PRINT
S102
K101
%J101
%P101





BECKMAN INSTRUMENTS, INC. - BERKELEY DIVISION

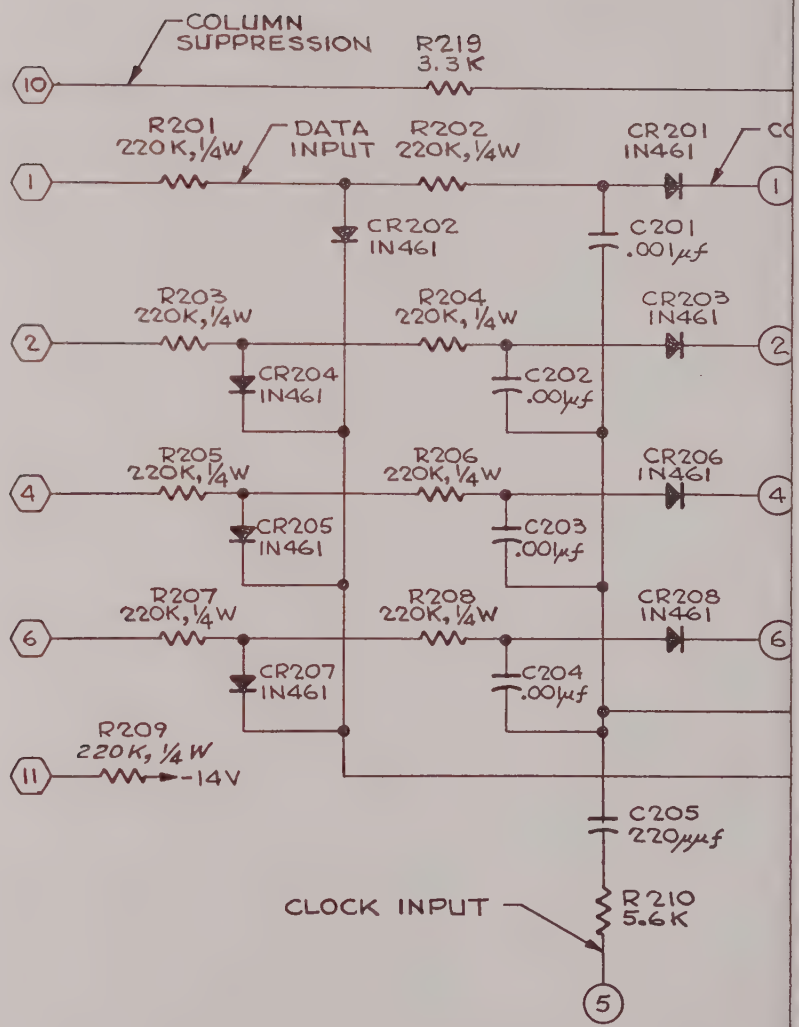
MODEL 1453 MASTER SCHEMATIC DIAGRAM



Beckman

August 1963

BECKMAN INSTRUMENTS, INC. - BERKELEY DIVISION



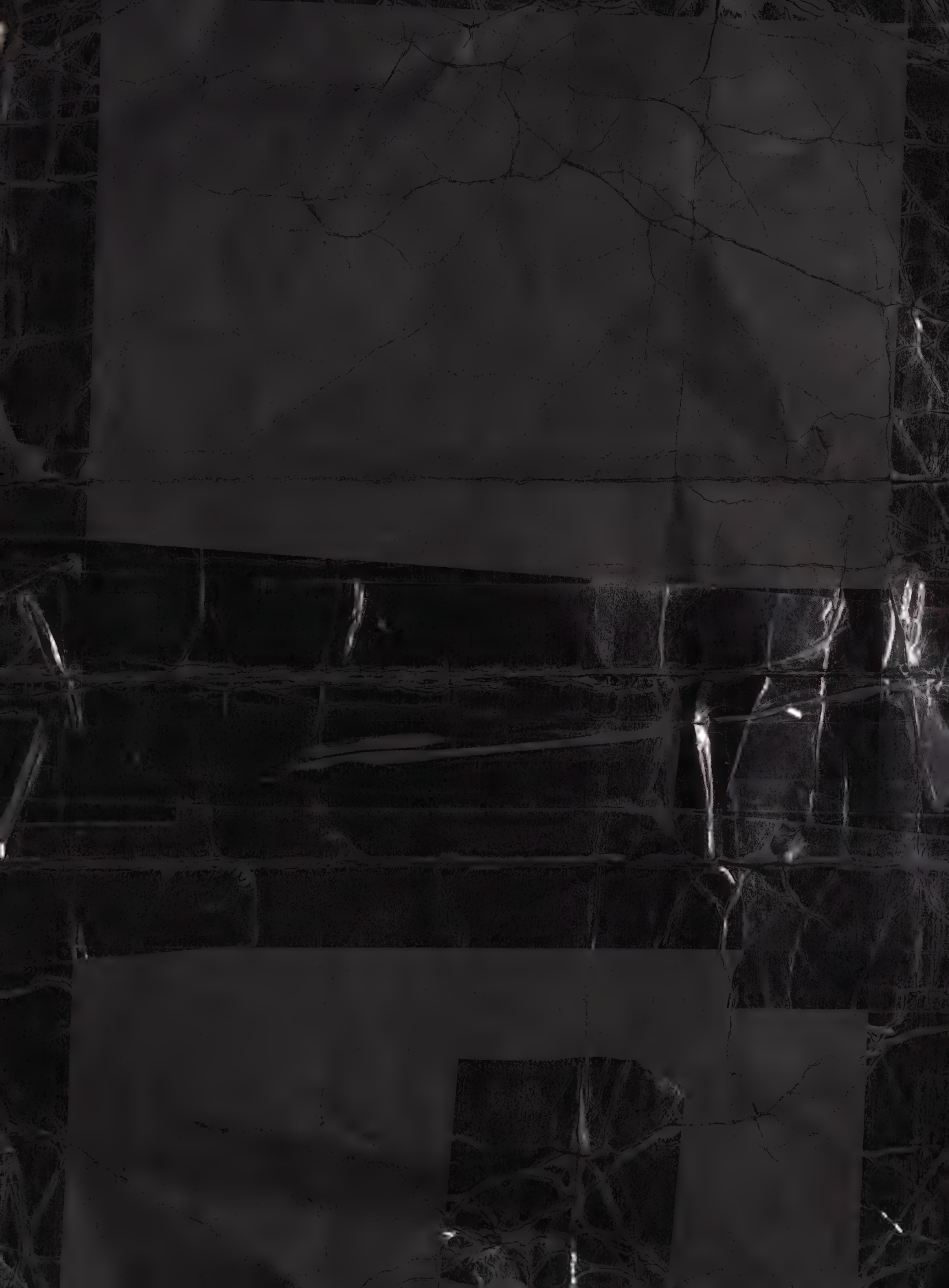
NOTE:

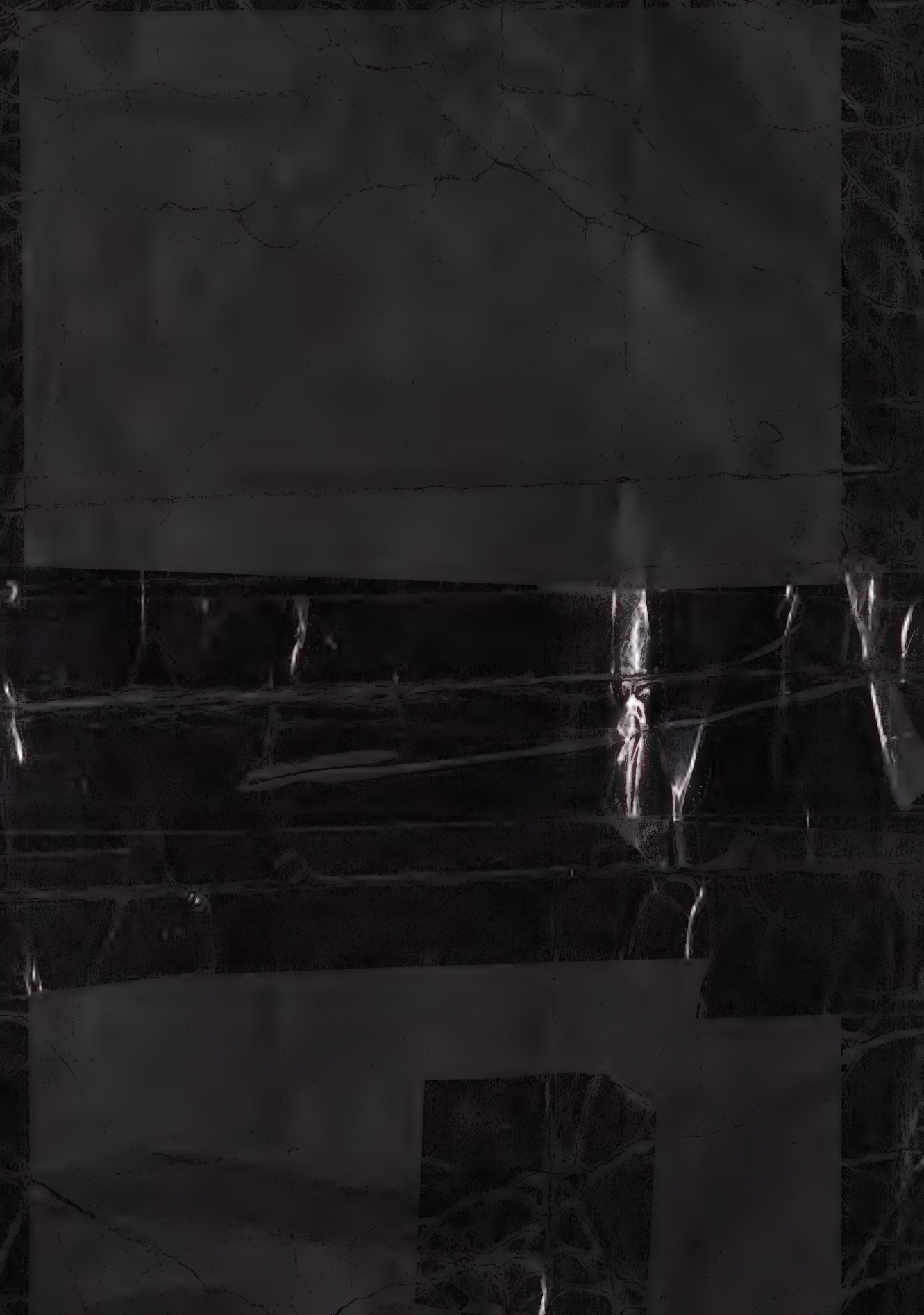
1) RESISTORS:
   WATTAGE — 1/2W UNLESS NOTED
   TOLERANCE — 10% " "

2) ⬡ — INDICATES PINS OF P201

3) ◯ — INDICATES PINS OF P202

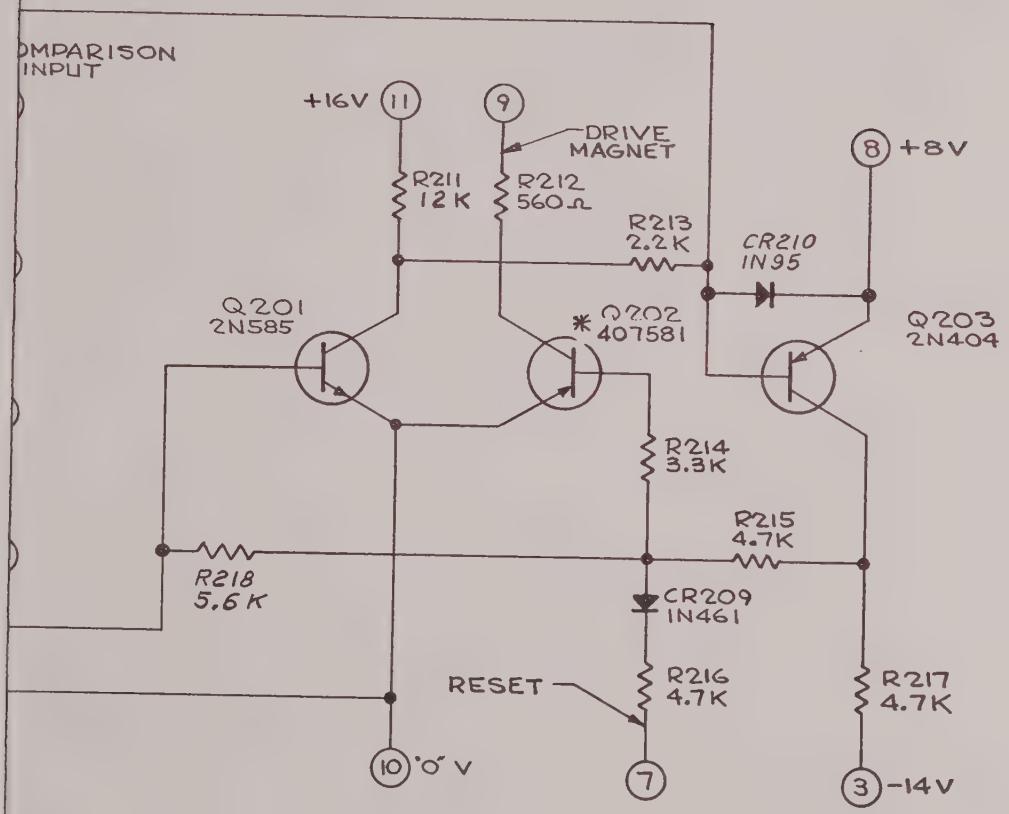
4) * BECKMAN PART NO.





BECKMAN INSTRUMENTS, INC. - BERKELEY DIVISION

FOUR-LINE INPUT MODULE
SCHEMATIC DIAGRAM



Model 1453
B 404461-Rev. B
December 1961

Beckman

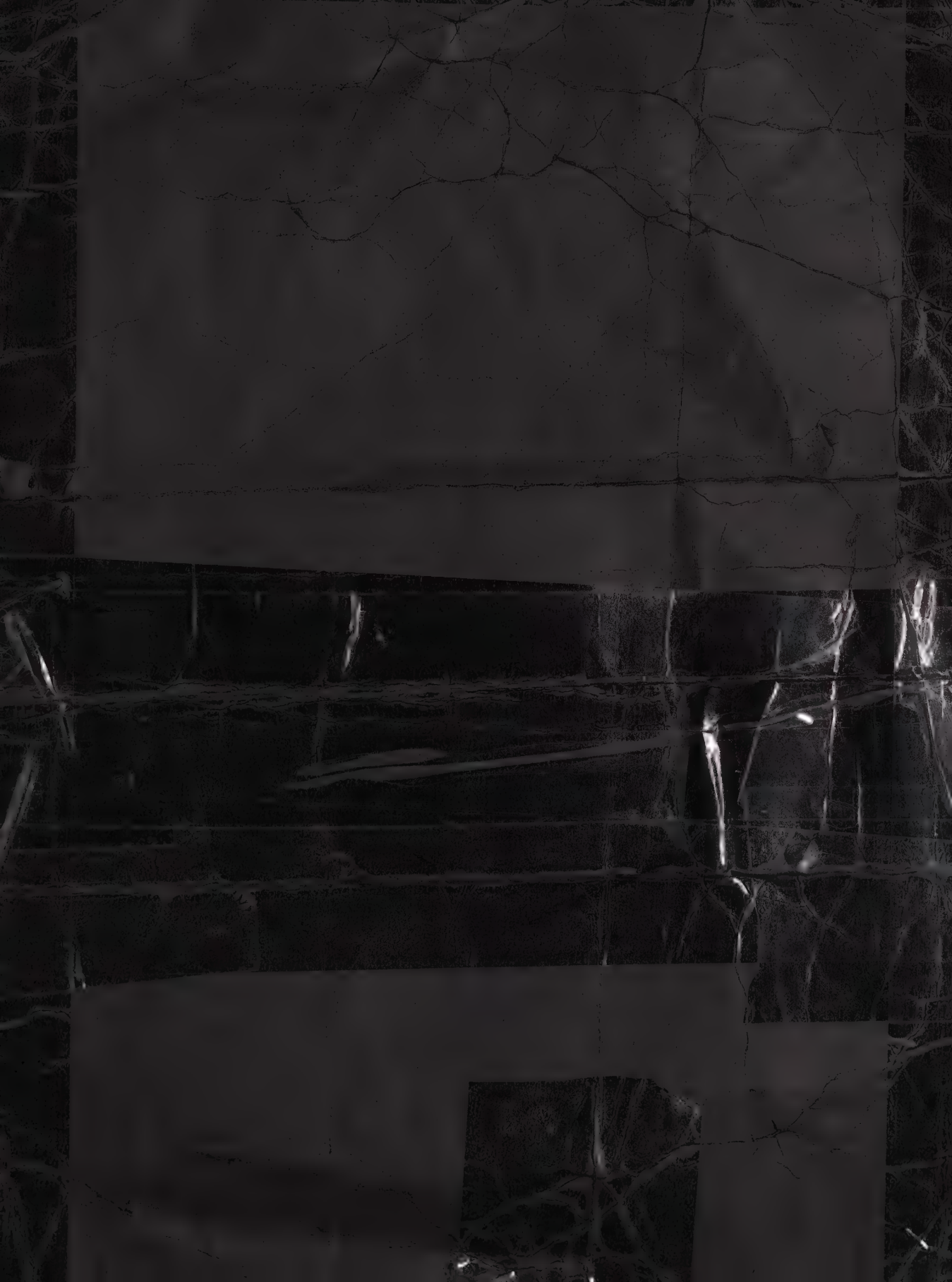
August 1963

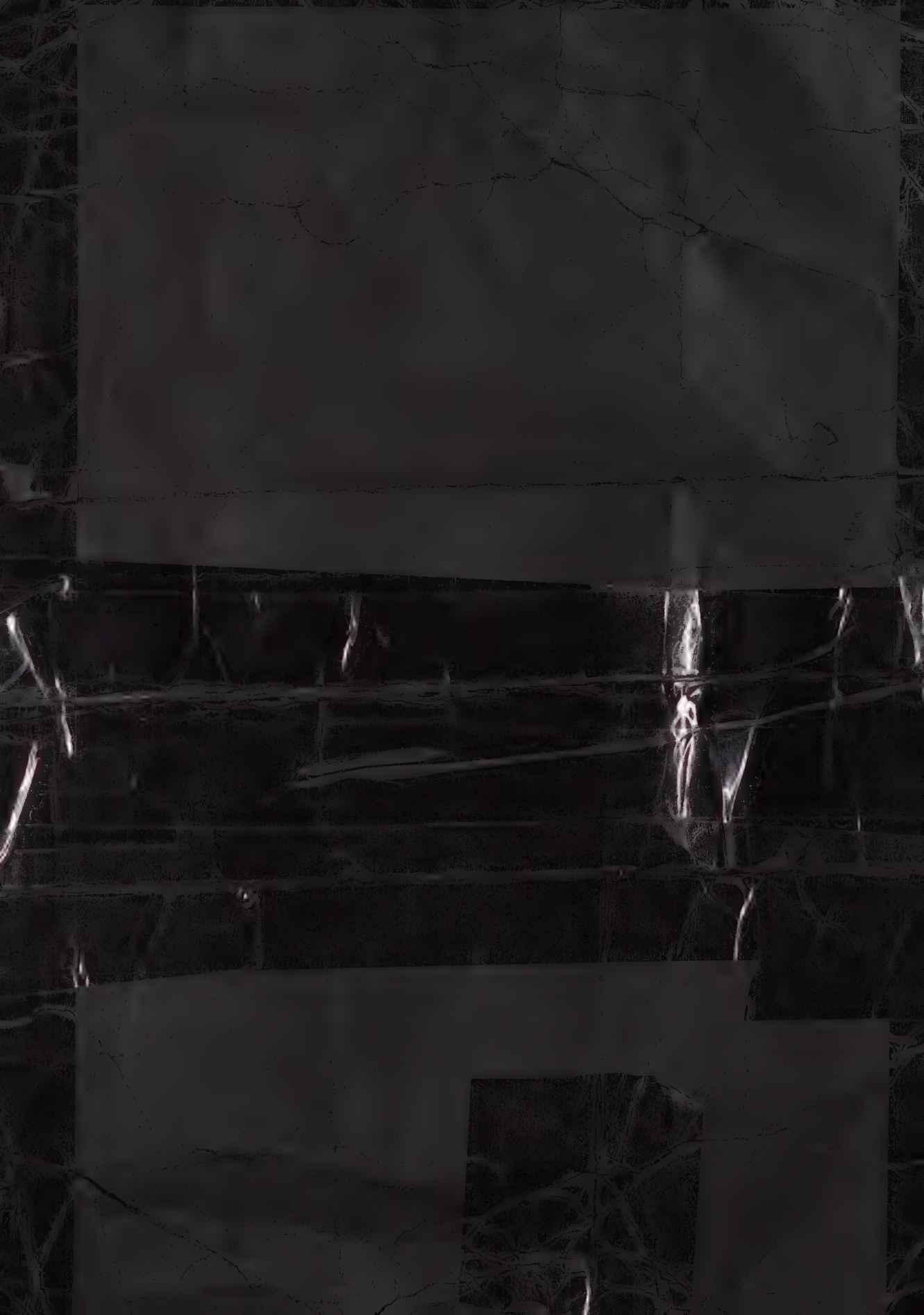
BECKMAN INSTRUMENTS, INC. - BERKELEY DIVISION

NOTE:

J401 thru J408 Amphenol 78-SIIT

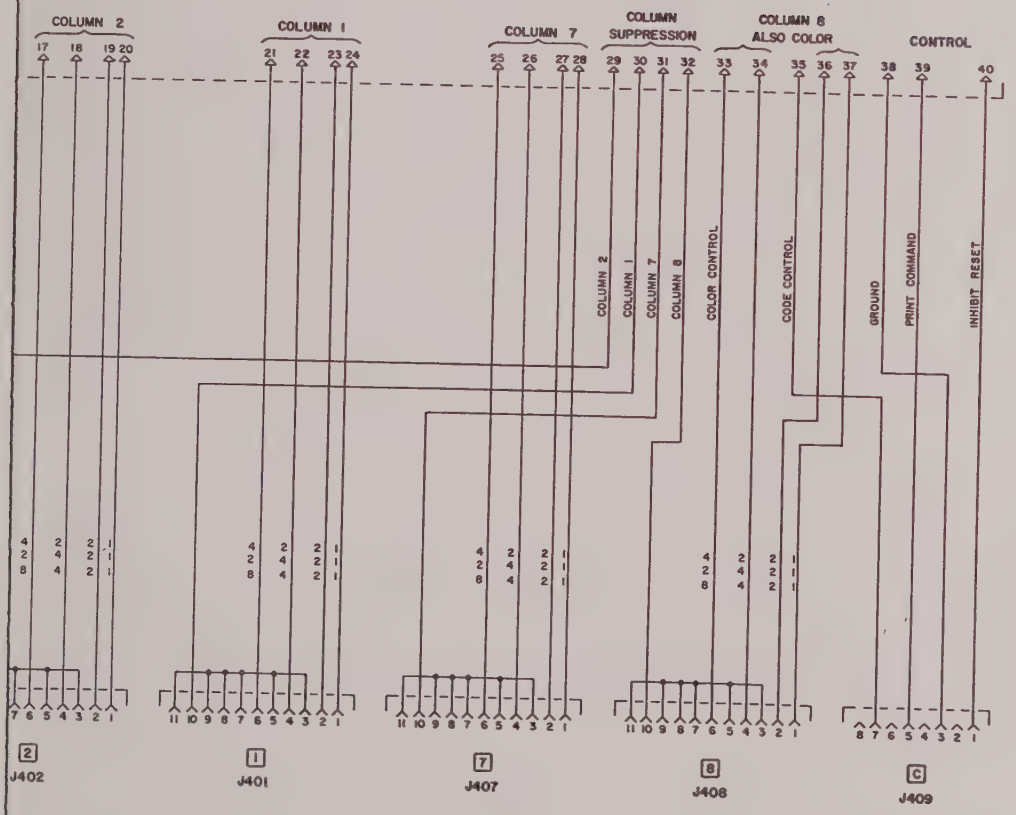
J409 Amphenol 78-S8





BECKMAN INSTRUMENTS, INC. - BERKELEY DIVISION

FOUR-LINE INPUT CABLE SCHEMATIC DIAGRAM



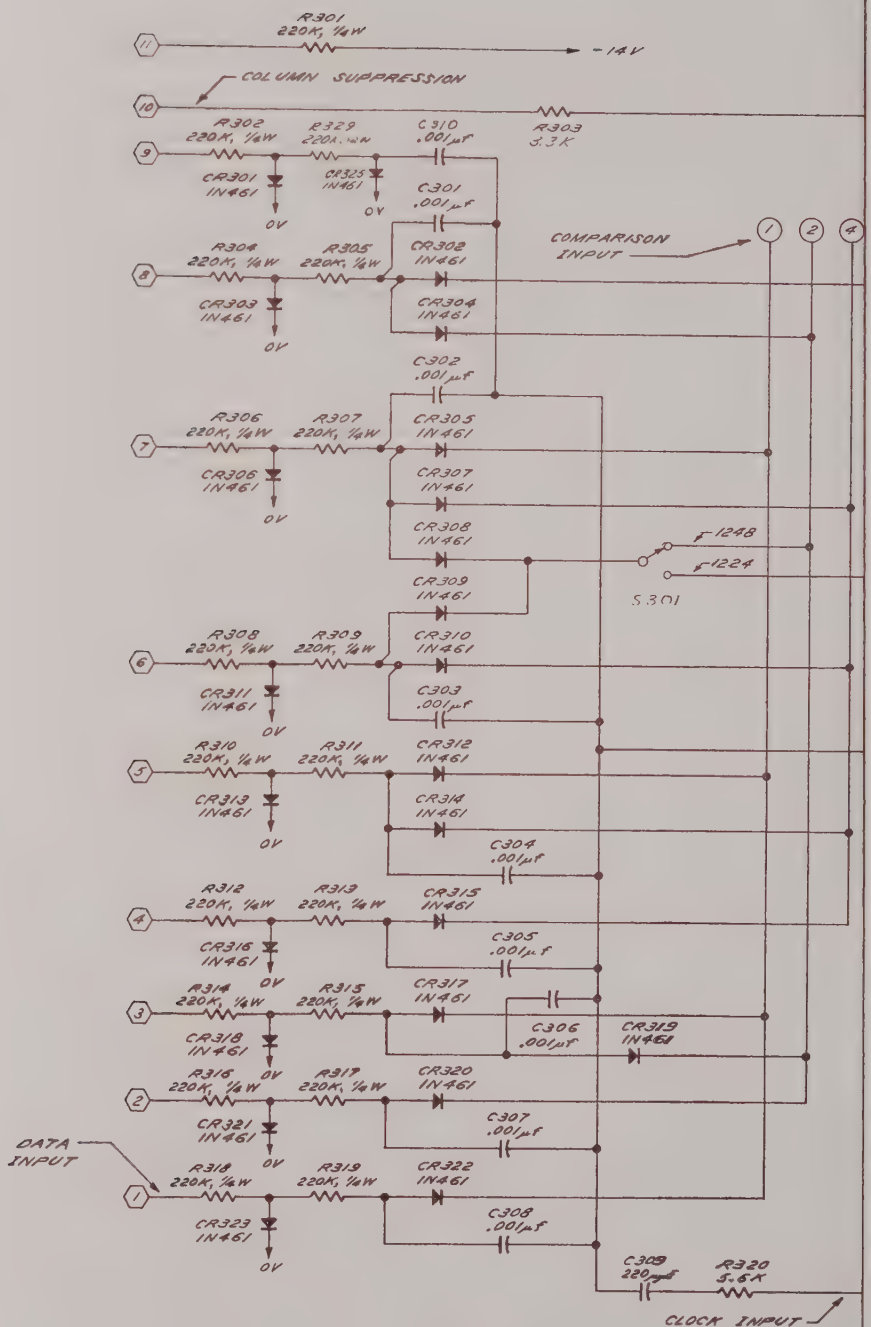
62-D-56

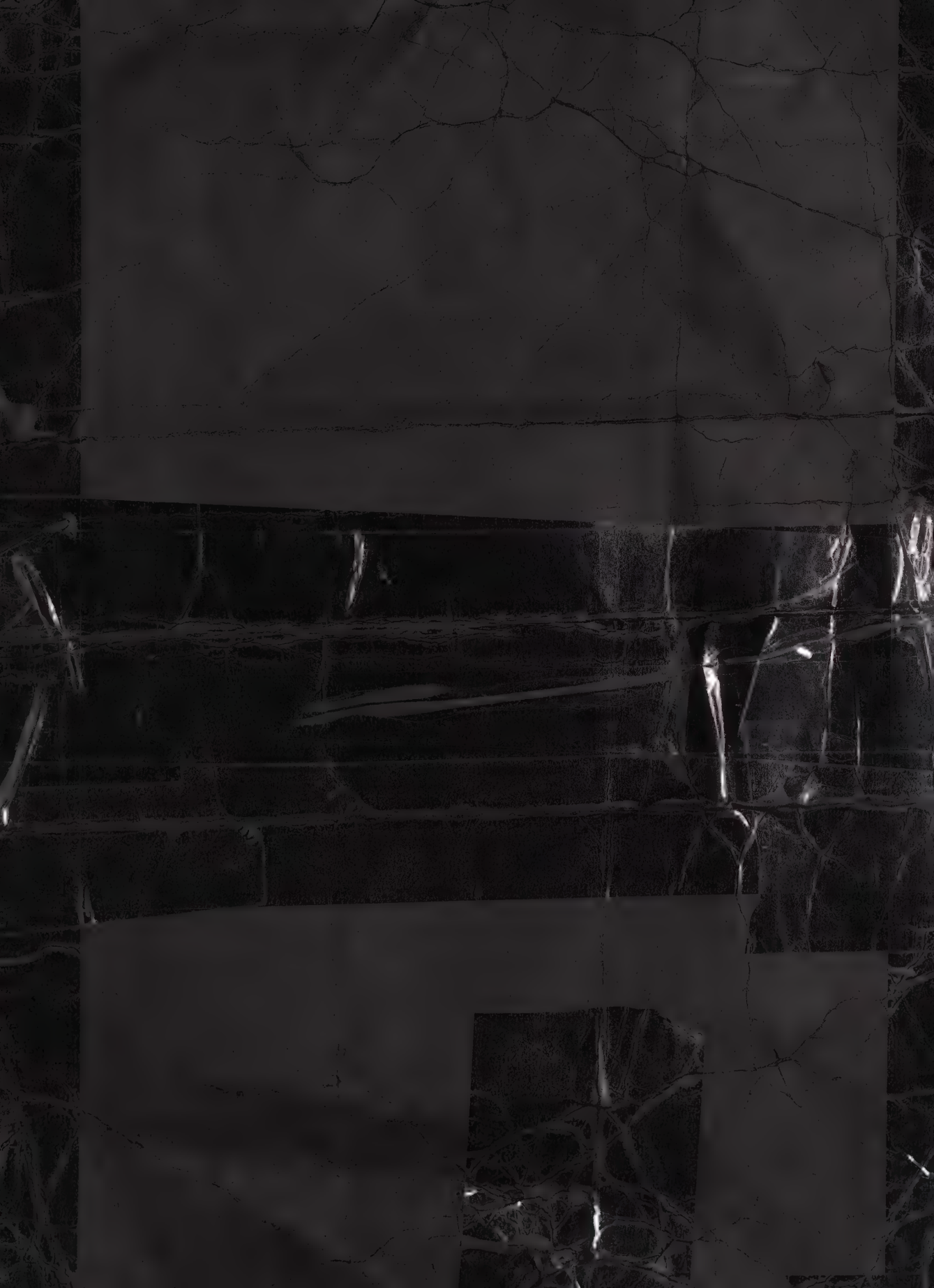
Model 1453
62-D-56
August 1962

Beckman

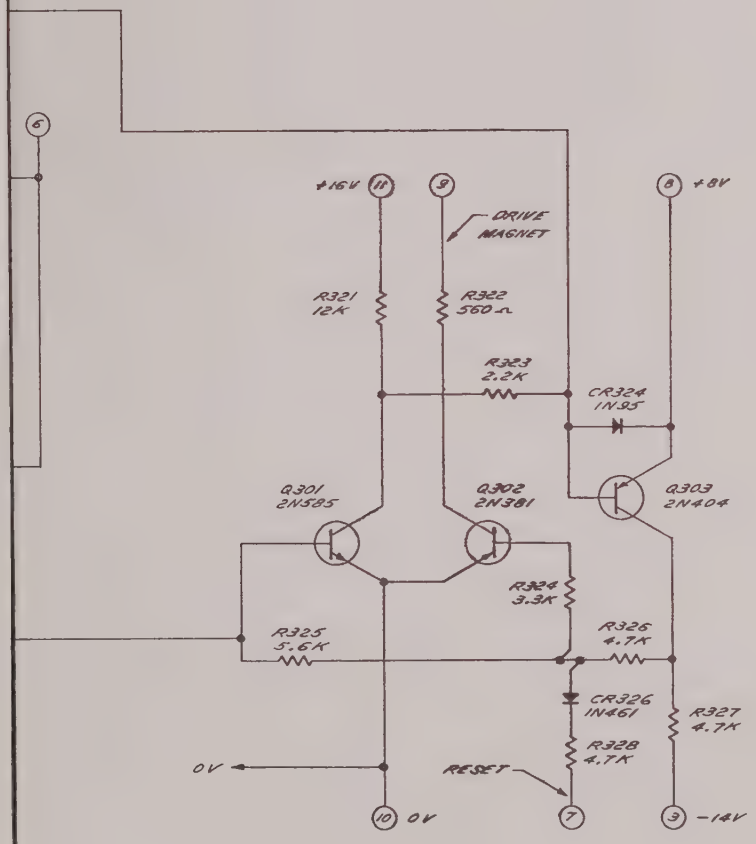
August 1963

BECKMAN INSTRUMENTS, INC. - BERKELEY DIVISION


R301
220K, 1/4W
-14 V
COLUMN SUPPRESSION
R303
3.3K
R302
220K, 1/4W
R329
220K, 1/4W
C310
.001µf
CR325
IN461
CR301
IN461
C301
.001µf
COMPARISON
INPUT
R304
220K, 1/4W
R305
220K, 1/4W
CR302
IN461
CR303
IN461
CR304
IN461
C302
.001µf
R306
220K, 1/4W
R307
220K, 1/4W
CR305
IN461
CR306
IN461
CR307
IN461
CR308
IN461
1248
1224
S 301
CR309
IN461
R308
220K, 1/4W
R309
220K, 1/4W
CR310
IN461
CR311
IN461
C303
.001µf
R310
220K, 1/4W
R311
220K, 1/4W
CR312
IN461
CR313
IN461
CR314
IN461
C304
.001µf
R312
220K, 1/4W
R313
220K, 1/4W
CR315
IN461
CR316
IN461
C305
.001µf
R314
220K, 1/4W
R315
220K, 1/4W
CR317
IN461
CR318
IN461
C306
.001µf
CR319
IN461
R316
220K, 1/4W
R317
220K, 1/4W
CR320
IN461
CR321
IN461
C307
.001µf
DATA
INPUT
R318
220K, 1/4W
R319
220K, 1/4W
CR322
IN461
CR323
IN461
C308
.001µf
C309
220
R320
5.6K
CLOCK INPUT
0V



TEN-LINE
INPUT CODE MODULE
SCHEMATIC DIAGRAM



NOTE:

1) RESISTORS:
   WATTAGE — ½ W., UNLESS STATED.
   TOLERANCE — 10%, " "
2) ⬡ — INDICATES PINS OF P301.
3) ◯ — INDICATES PINS OF P302.

Model 1453
C 404454-Rev. A
March 1962

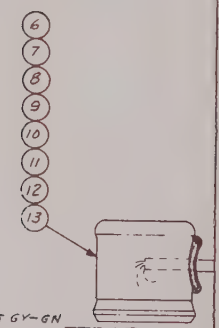
Beckman®

August 1963

BECKMAN INSTRUMENTS, INC. - BERKELEY DIVISION

	WIRE NO.	PIN NO.	COLOR
GROUP 1	910		BN - BK
	911		BN - BN
	912		BN - RD
	913		BN - OR
	914		BN - YL
	915		BN - GN
	916		BN - BL
	917		BN - VO
	918		BN - GY
	919		BN - WH
GROUP 2	920		RD - BK
	921		RD - BN
	922		RD - RD
	923		RD - OR
	924		RD - YL
	925		RD - GN
	926		RD - BL
	927		RD - VO
	928		RD - GY
	929		RD - WH
GROUP 3	930		OR - BK
	931		OR - BN
	932		OR - RD
	933		OR - OR
	934		OR - YL
	935		OR - GN
	936		OR - BL
	937		OR - VO
	938		OR - GY
	939		OR - WH
GROUP 4	940		YL - BK
	941		YL - BN
	942		YL - RD
	943		YL - OR
	944		YL - YL
	945		YL - GN
	946		YL - BL
	947		YL - VO
	948		YL - GY
	949		YL - WH
GROUP 5	950		GN - BK
	951		GN - BN
	952		GN - RD
	953		GN - OR
	954		GN - YL
	955		GN - GN
	956		GN - BL
	957		GN - VO
	958		GN - GY
	959		GN - WH
GROUP 6	960		BL - BK
	961		BL - BN
	962		BL - RD
	963		BL - OR
	964		BL - YL
	965		BL - GN
	966		BL - BL
	967		BL - VO
	968		BL - GY
	969		BL - WH
GROUP 7	970		VO - BK
	971		VO - BN
	972		VO - RD
	973		VO - OR
	974		VO - YL
	975		VO - GN
	976		VO - BL
	977		VO - VO
	978		VO - GY
	979		VO - WH
GROUP C	981		GY - BN
	983		GY - OR
	985		GY - GN
	986		GY - BL
	987		GY - VO

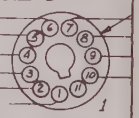
IDENTIFICATION TAG FOR GROUP NUMBER

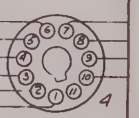


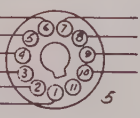
PRINT COMMAND 985 GY-GN

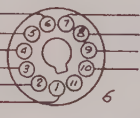
GROUND 983 GY-OR

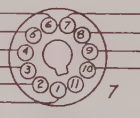
INHIBIT RESET 981 GY-BN

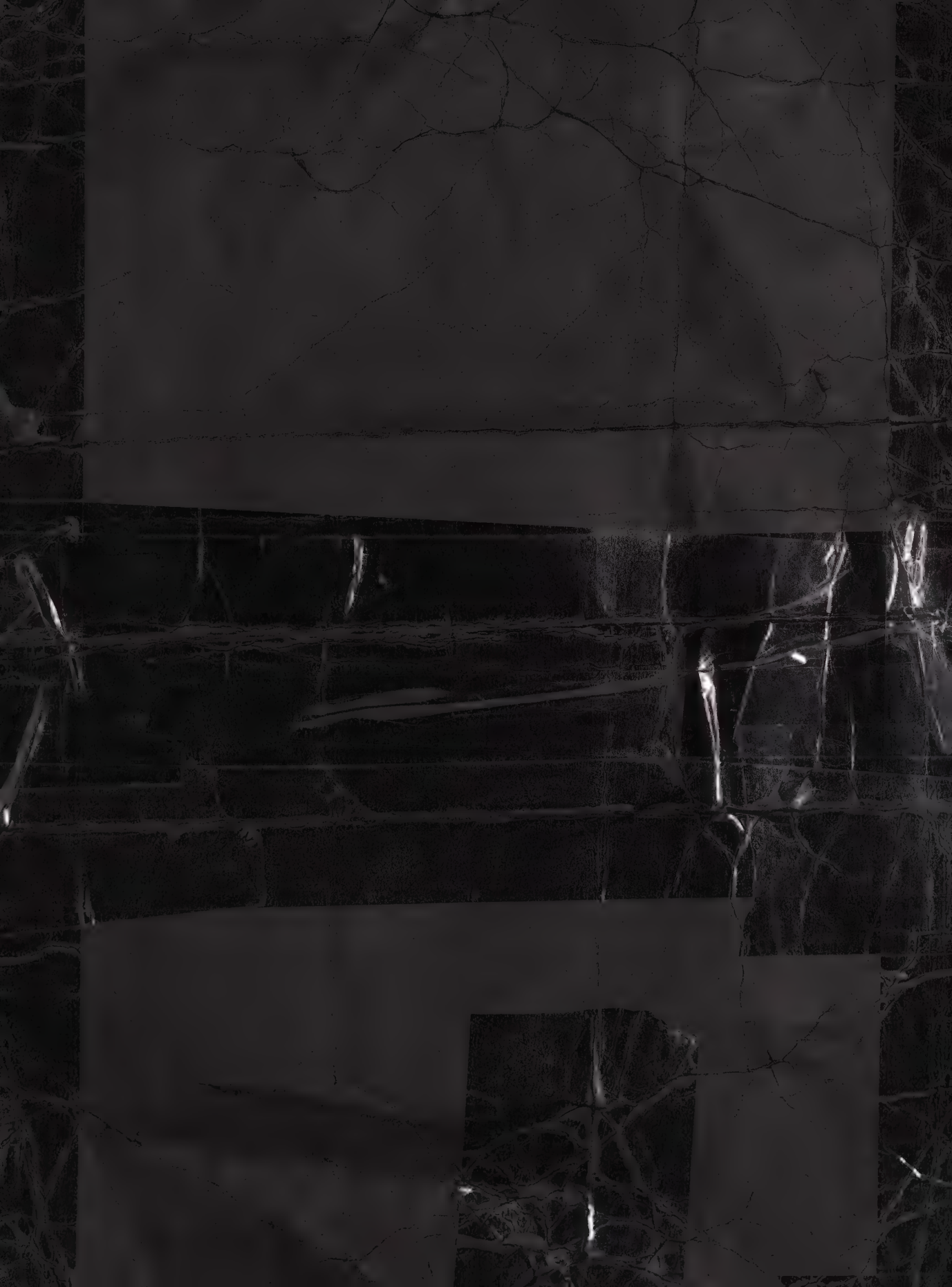


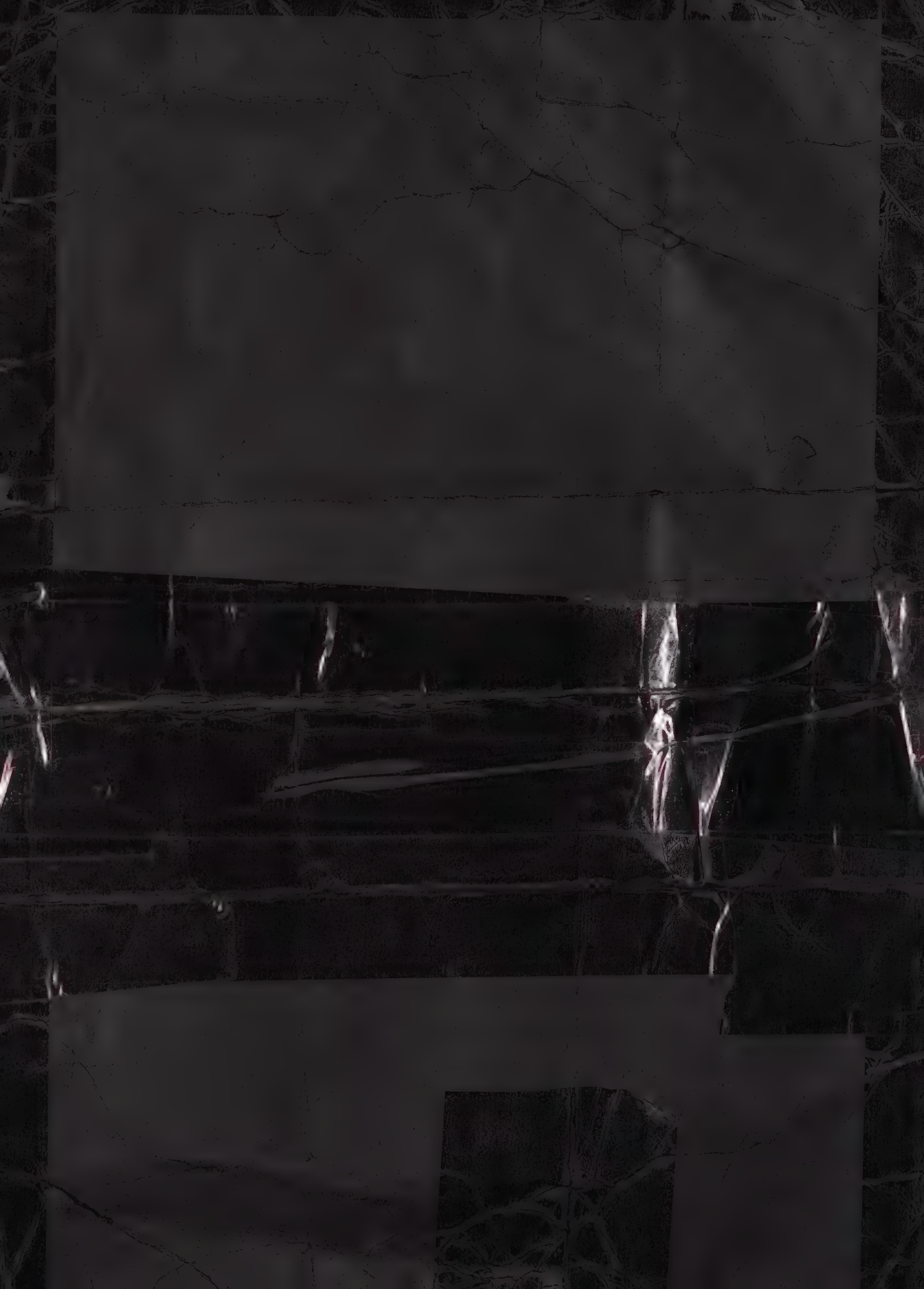






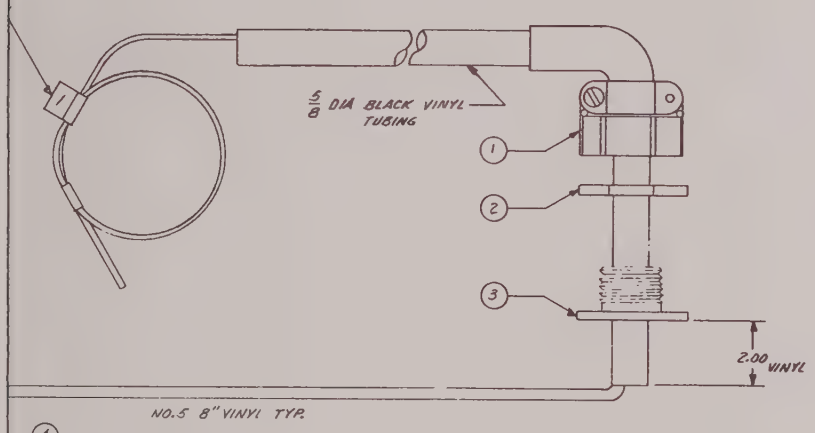






BECKMAN INSTRUMENTS, INC. - BERKELEY DIVISION

TEN-LINE INPUT CABLE SCHEMATIC DIAGRAM



NOTES:
1) WIRE LENGTHS TO BE 12'0".
2) VINYL LENGTH TO BE 10'0".

④
- 926 GY-BL COLOR CONTROL
- 927 GY-VO CODE CONTROL

⑤
- 917 BN-VO
- 918 BN-GY
- 919 BN-WH
- 910 BN-BK

- 927 RD-VO
- 928 RD-GY
- 929 RD-WH
- 920 RD-BK

- 937 OR-VO
- 938 OR-GY
- 939 OR-WH
- 930 OR-BK

- 947 YL-VO
- 948 YL-GY
- 949 YL-WH
- 940 YL-BK

ITEM	PART NO	DESCRIPTION	QTY
13	T697-404585	HOOD SILKSCREEN C	1
12	T697-404579	7	1
11	T697-404578	6	1
10	T697-404577	5	1
9	T697-404576	4	1
8	T697-404575	3	1
7	T697-404574	2	1
6	T697-404573	1	1
5	860-011948	11 PIN SOCKET	7
4	860-023566	8 PIN SOCKET	1
3	A699-404566	CANNON AN3064-10	1
2	699-801709	CANNON AN3066-10	1
1	697-806983	CANNON AN3057-10A	1

62-C-114

Model 1453
62-C-114
March 1962

Beckman

August 1963

BECKMAN INSTRUMENTS, INC. - BERKELEY DIVISION

EASTERN REGIONAL SALES OFFICES

Route 22, Summit Road
Mountainside, New Jersey
Phone: ADams 2-7600 (area code 201)
BArclay 7-9891 - New York
(area code 212)

12224 Rockville Pike
Rockville, Maryland
Phone: OLiver 6-1644 (area code 301)

1 Bala Avenue
Bala Cynwyd, Pennsylvania
Phone: TE. 9-3844

NOTE: Factory repair facility is located at the Mountainside office.

BECKMAN/BERKELEY REPRESENTATIVES

BROGER INSTRUMENTS, INC.:

48 Pearl Street
Brookline 47, Mass. 02147
Phone: BEacon 2-4804 (area code 617)

31 Broadway
P. O. Box 2917
New Haven 15, Conn. 06515
Phone: SPruce 7-6279 (area code 203)

DANNEMILLER-SMITH, INC.:

2120 South Post Oak Road
Houston 27, Texas
Phone: SUnset 2-7350 (area code 713)

2712 West Mockingbird Lane
Callas 35, Texas
Phone: FLeetwood 7-8249
(area code 214)

LEEMARK ASSOCIATES, INC.:

4021 West 86th Street
Prairie Village, Kansas
Phone: NIagara 2-3313 (area code 913)
Kansas City: JA. 3-4551 (area code 816)

2001 Big Bend Boulevard
St. Louis 17, Missouri
Phone: MIssion 7-1470 (area code 314)

MURPHY & COTA:

712 W. Vassar Avenue
Orlando, Florida
Phone: GArden 4-2167 or GArden 4-5633
(area code 305)

2110 Peachtree Road, N.W.
Atlanta 9, Georgia
Phone: TRinity 6-3020 (area code 404)

1106 Burke Street
Winston-Salem, North Carolina
Phone: PArk 4-0750 or PArk 4-1535
(area code 919)

112 Gallatin Street, S.W.
Huntsville, Alabama
Phone: JEfferson 6-9121 or JE 9-8476
(area code 205)

RIDGWAY ASSOCIATES:

3384 Twelve Mile Road
Berkley, Michigan
phone: LIncoln 6-3312

5249 Broadview
Cleveland 34, Ohio
Phone: SHadyside 9-6626
(area code 216)

continued ...

RIDGWAY ASSOCIATES - continued:

3759 North Harlem Avenue
Chicago 34, Illinois
Phone: 282-5929 (area code 312)

4915 North College Avenue
Indianapolis 2, Indiana
Phone: MElrose 5-2401 (area code 317)

3898 Linden Avenue
Dayton 32, Ohio
Phone: CLearwater 2-5604
(area code 513)

7736 Morgan Avenue, South
Minneapolis, Minnesota
Phone: 866-3305 (area code 612)

R-O-R ASSOCIATES LTD.:

1470 Don Mills Road
Don Mills, Ontario, Canada (head office)
Phone: HIckory 4-4429 (area code 416)

864 Lady Ellen Place
Ottawa 3, Ontario, Canada
Phone: Parkway 9-1585 (area code 613)

3333 Cavendish Boulevard
Montreal, N. D. G., Quebec, Canada
Phone: HUnter 1-0700 (area code 514)

V. T. RUPP COMPANY:

307 Parkman Avenue
Los Angeles 26, California
Phone: DUnkirk 7-8224 (area code 213)

1182 Los Altos Avenue
Los Altos, California
Phone: WHitecliff 8-1483

3445 - 5th Avenue
San Diego 3, California
Phone: CYpress 8-9835 (area code 714)

1437 San Mateo, N. E.
Albuquerque, New Mexico
Phone: ALpine 6-0798 (area code 505)

SBM ASSOCIATES:

139 East Main Street
Elmsford, New York
Phone: LY. 2-8850 (area code 914)

177 Winton Road, North
Rochester 10, New York
Phone: OLympic 4-8440 (area code 716)

1943 West Fayette Street
Syracuse, New York
Phone: HOward 8-5041 (area code 315)

SHOWALTER-JUDD:

1806 South Bush Place
Seattle 44, Washington
Phone: EAst 4-7911 (area code 206)

WILLIAMS ASSOCIATES:

4971 Jackson Street
Denver 16, Colorado
Phone: 388-4391 (area code 303)

362 Pierpont Avenue
Salt Lake City, Utah
Phone: 328-3101 (area code 801)

International Division
Beckman Instruments, Inc.
2500 Harbor Blvd.
Fullerton, California
Phone: TRojan 1-4848

Systems Division
Beckman Instruments, Inc.
2400 Harbor Boulevard
Fullerton, California
Phone: TRojan 1-4848

Beckman/Berkeley Division
2200 Wright Avenue
Richmond, California
Phone: LAndscape 6-7730

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